Patroller's Manual

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2022 Edition

CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI

Advanced First Aid

2022 Edition

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Foreword

The Canadian Ski Patrol Patroller's Manual is issued under the authority of the Canadian Ski Patrol (CSP) Board of Directors.

This edition of the manual is effective upon publication and supersedes all earlier editions. Suggestions for amendments should be forwarded to the National Office of the CSP.

Acknowledgements

The CSP expresses its appreciation to other organizations who have contributed information for use in this manual, to individuals outside of the CSP who have advised and assisted in its development and to many of its members who spent countless hours writing, illustrating, editing and proof reading the material. Without this devoted support this manual could never have been produced.

The skills performance guidelines for basic life support (BLS) in this training program have been developed by the Canadian Ski Patrol in collaboration with the Heart and Stroke Foundation of Canada, the Canadian Red Cross Society, the Life Saving Society Canada and St. John Ambulance.

Preface

This CSP Patroller's Manual provides to patrollers and prospective patrollers the basic elements of patrolling and advanced first aid essential to the effective and efficient conduct of their duties. The manual contains the key information upon which system-wide membership evaluations will be based. For ease of reading, the pronoun he, wherever used, refers to both the male and female person without discrimination.

This manual is not to be construed as all encompassing. It is a uniform guide to a fundamental understanding of the CSP organization, first aid, procedures and programs. This information is based on the knowledge, expertise and accumulated experience of many people.

The CSP Patroller’s Manual demonstrates one method of practice that is effective in the majority of situations encountered by patrollers. It does not purport to be the sole method. Patroller and patient safety is paramount at all times and in all practices. Patroller instruction reflects an outcomes-based learning approach.

The reader is encouraged to broaden his knowledge and skills by referring to other relevant reference material and by dedicated practice.

By proper use of this manual, an unsurpassed standard of proficiency can be achieved by the members of the CSP, which will permit the CSP to fulfill its objectives of safety and service to the snow sliding public of Canada in a competent manner.

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The course material in this manual meets or exceeds CSA Standard Z1210-17 and Z1220-17.

The following individuals have contributed to making this edition of the Advanced First Aid CSP Patroller's Manual possible:

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Many patrollers from across the country also helped to improve the CSP Patroller’s Manual by submitting education change requests. Thank you!

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Special thanks to all the spouses, partners and friends that had the patience to endure the endless hours spent by the CSP members on the production of this edition and also to those who supported the continuous improvement of the CSP manuals by their contributions to previous editions.

About the Canadian Ski Patrol

The Canadian Ski Patrol is a non-profit corporation comprising highly-trained volunteer members. The organization is national in scope, and was formed to promote safe skiing and to provide assistance to injured skiers and other snow sliders. The CSP provides a uniformly highly-skilled and responsible service to the snow sliding public.

Originally founded in 1941 by Dr. Douglas Firth, the corporation was constituted under the name of the Canadian Ski Patrol System as a non-profit corporation, without share capital, under letters patent issued under the seal of the Secretary of State of Canada, and dated the 20th of August 1962.

Fast facts

- The CSP is comprised of more than 4,000 volunteers from coast to coast to coast in Canada in 61 zones and nine divisions.
- The organization provides first aid services at 230 Alpine and Nordic ski areas across Canada.
- Members annually provide in excess of 260,000 hours of service to these ski areas.
- Members also provide in excess of 12,000 hours of first aid services at off-snow events which includes events such as marathons, mountain bike races, concerts, etc.
- Our patron is the Governor General of Canada.
- The majority of CSP members volunteer their time for the services they deliver. A number also become paid patrollers at ski resorts across Canada.
- The CSP also provides on-snow training, safety and incident scene management training to members.
- The advanced first aid course is recognized by the majority of the provinces and territories in Canada.
- Patrollers must update their advanced first aid qualifications every year by taking a course that is a minimum of 16 hours and passing written, skills and diagnostic evaluations.
- The CSP medical advisory committee is comprised of up to six physicians and the pre-hospital care advisory committee is comprised of four pre-hospital care or hospital emergency workers who are CSP members.
- The CSP provides insurance coverage for each member for the first aid services provided.
- The CSP is a founding member of the Fédération Internationale des Patrouilles de Ski (FIPS), an international corporation made up of ski patrol organizations representing ski patrollers and ski safety bodies in their respective countries.

For more information or to join, please visit the Canadian Ski Patrol website at www.skipatrol.ca.

1. Introduction to first aid

Learning outcome:

Identify and show understanding of the role and responsibilities of the patroller, and the qualities needed to be effective in this role.

Upon completion of this chapter you should be able to:

1. Define first aid.
2. List the qualities of a good patroller.
3. List the seven steps of responsibility of a patroller.
4. Differentiate between actual consent and implied consent.

In this chapter:

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What is first aid?

First aid is the initial emergency care provided to a person suffering from trauma or sudden illness until professional medical assistance is available to take over the care of the injured person.

The aim of first aid is to:

- save lives
- prevent a patient's condition from worsening
- alleviate or minimize suffering until professional medical care becomes available

First aid is the first link in the emergency medical services (EMS) system.

What makes a good patroller?

A good patroller is someone who:

- has technical knowledge by virtue of their training and learning
- holds a current first aid certificate
- is able to use their knowledge to assess the situation and administer first aid as needed
- is able to react confidently under pressure
- presents and maintains a professional appearance

First aid provider responsibility

A patroller's responsibility is to take charge of an emergency situation through definitive command and confident action. Below is a description of your responsibilities as a patroller when handling an emergency situation.

Survey the scene

Evaluate the overall situation to determine the nature of the emergency and extent of the injuries. Assess the scene for danger to yourself, bystanders and the patient. If it is safe to do so, remove the danger, if not, move the patient and bystanders away from the danger.

Evaluate signs and symptoms

Both signs and symptoms are important. A sign is something you observe or detect, such as bleeding or shortness of breath. A symptom is a feeling that the patient experiences and reports to you, such as: "I have a pain in my chest," or "I'm dizzy."

In assessing a patient, consider the signs and symptoms to determine the problem and respond to the emergency.

Gather information about the incident and the injured

As a trained patroller, your arrival on the scene is usually all that's needed to provide a sense of comfort and security to the injured. "I am a member of the Canadian Ski Patrol trained in first aid. May I help you?" is often very welcome.

After you have been given consent to help, "What's wrong?" is the obvious question. Frequently, though, the patient is confused and upset. Your best source of information may come from witnesses, friends or MedicAlert tags.

This information, together with the signs and symptoms, enables you to best assess and evaluate the situation.

Be professional

Be calm and reassure the injured person. Words of comfort are an important first aid measure to the injured person; they prevent anxiety-induced complications and help simplify the examination and handling of injuries.

Keep curious bystanders out of the area or assign them to non-critical tasks. This will help keep them out of your way, occupied and safe. If you delegate responsibilities to others, ensure that assigned actions are carried out.

Prompt and effective care

This manual and the training given by the Canadian Ski Patrol will provide you with the knowledge and necessary training to deliver prompt and effective care to the injured person.

Communicate with appropriate personnel

Establish and maintain communication links with medical services to ensure prompt action is undertaken. Seek competent help wherever possible and as soon as you can.

Arrange transport of the injured person to medical assistance

First aid provides immediate and temporary care. It is the first link in the emergency medical services (EMS) system.

It is your responsibility to be that first link and to pass your patient to professional medical services.

Communicate and report incident details

It is good practice to record in writing the details of any first aid you provide at an incident as well as any observations. This information will be invaluable to the medical personnel who will subsequently treat or deal with your patient. It may also be necessary if the incident is brought to court.

Legal considerations

There are legal aspects that must be considered when administering first aid. Each province has its own laws which you must consider.

When not on duty, you may come across someone that is injured. You may choose to offer assistance including providing first aid. In that case, all provinces and territories have Good Samaritan laws which generally protect you from legal liability when assisting injured people. CSP general liability does not provide coverage outside of patrol activities.

Possible provincial treatment restrictions

This CSP Patroller's Manual provides medical and first aid information, treatment protocols and techniques to meet the national standards of the CSP Advanced First Aid course. Candidates must be trained in, and meet, all requirements to be certified. However, each province may have legislative requirements that limit or restrict the application of some CSP protocols in that province. Where present, these restrictions will be identified during training and those restricted protocols will not be used in that province. When visiting a different province to patrol, members are reminded to inquire if there are any provincial restrictions regarding any CSP treatment protocols.

Legal protection

Your best protection is to be properly trained and qualified to a recognized set of standards. When administering first aid, you must adhere to those standards and only provide care to the level you have been trained and qualified in.

Consent

Before giving first aid to a patient, it is necessary to ask for their permission to do so. Identify yourself and ask, "May I help you?"

Actual consent

If the patient is an adult, conscious and mentally competent, they need only respond yes or no. This verbal consent is all that is required.

Implied consent

If the patient is unable to respond, that is they are unresponsive, the law assumes they would have provided consent in an emergency situation where there is a risk of further injury. If they become conscious, you must obtain their actual consent to continue assisting them.

In cases where ego or pride result in the injured person refusing assistance, ensure that they can in fact function safely without assistance. If not, repeat the offer to assist them.

If the injured person is a child, clearly explain what you are going to do to help them and obtain their consent. If a parent or guardian is available, you must ask for their consent.

Occupational health and safety (OHS)

Each province and territory have its own OHS legislation, regulations and/or codes. Local training will be provided on the basic principles of the OHS legislation, regulations and/or codes and how they apply to a patroller as a workplace first aider in their province or territory.

Hazards

A hazard is any object, situation or behaviour that has the potential to cause injury, ill health or damage to property or the environment.

Health and safety hazards exist in every workplace, which includes ski areas. Some are easily identified and corrected, while others are necessary risks of the job and must be managed in other ways, for example by using protective equipment.

Most occupational hazards are inactive or have a low potential of occurring; however, patrollers must be prepared to deal with them since a hazard that becomes active can generate an emergency.

Hazards can be classified as:

- Physical hazards: these are the most common hazards and include extremes of temperature in which patrollers work, both cold and hot, working from heights, electrical exposure, fire, confined spaces, broken glass, and many other sources.
- Mechanical hazards: these are usually created by machinery and other equipment, often with moving parts.
- Chemical hazards: these appear when a patient or patroller is exposed to chemicals.
- Biological hazards: these include viruses, bacteria, fungus, parasites and bodily fluid that can infect or transmit diseases to human beings.

- Ergonomic hazards: these include considerations of the total physiological demands of the patroller's job, including lifting and transporting injured persons and toboggan handling.
- Psychosocial hazards; these may arise from a variety of psychosocial factors that the patroller may be exposed to and finds to be unsatisfactory, frustrating and demoralizing, including workplace harassment and exposure to traumatic incidents.

Hazard management

Physical and mechanical hazards must be assessed and managed during the patroller's scene survey when approaching an incident. Incident site management is covered in the CSP On Patrol Manual, Chapter 7 Incident site management.

All patrollers have a responsibility to assist the ski area, or event, operations staff in identifying and minimizing any hazards that may be encountered while patrolling. Identifying and dealing with hazards found in a ski area or at an event site are covered in the CSP On Patrol Manual, Chapter 8 Risk management.

Chemical hazards are managed through the Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) which provide information on the safe storage and handling procedures for chemical products and the first aid measures to be followed in the event of exposure.

Biological hazards are managed through the adoption of standard precautions and the safe disposal of contaminated material (see Standard precautions in Chapter 3).

Ergonomic hazards are managed by using proper lifting techniques in the movement of injured persons (see Transporting patients in chapter 21) Patrollers should also ensure that first aid equipment can be easily removed from and replaced into its storage location and that the layout of the patrol hut or medical facility aids the safe and efficient treatment of injured persons.

The CSP Mutual Respect Policy and the dispute resolution mechanisms contained therein should be used to minimize psychosocial hazards caused by workplace harassment. Critical debriefing is available to deal with the psychosocial hazards caused by exposure to traumatic incidents that result in critical incident stress.

Administration of medications

Patrollers may be called upon to assist with administration of medications to a patient. Each province and territory has its own OHS legislation requirements which must be considered before assisting with the administration of medication; area-specific protocols may also apply.

This manual describes the role of the patrollers ih the administration of the following medications, where allowed:

- Oxygen for cardiac emergencies, respiratory emergencies, altered level of consciousness, shock and head injuries
- Acetaminophen (e.g., Tylenol™) for pain management
- Entonox or equivalent, for pain management (extended protocols only)
- Antibiotic cream or ointment for wound infection control
- Epinephrine (e.g. EpiPen™ or Allerject™) for anaphylaxis
- Nitroglycerin for angina attack.
- Salbutamol (e.g., Ventolin™) or budesonide / formoterol (e.g., Symbicort Turbohaler™) for asthma attack

- Acetylsalicylic acid (ASA) (e.g. Aspirin™) for heart attack or angina attack
- Sugar for hypoglycemia
- Lidocaine spray (e.g. Solarcaine™) for pain relief and infection control from sunburn and ultraviolet light exposure
- Antidotes (e.g. naloxone (NarCan™)) for opioid overdose.

First aid kits

Ski area first aid kits and equipment

Ski area management is responsible for providing first aid kits and equipment in the patrol hut or ski area medical facility in accordance with federal, provincial and territorial OHS requirements for workplace first aid kits and equipment. Additional first aid kits and equipment, for example oxygen equipment, large splints, backboards and toboggans, may also be provided at other locations within the ski area in accordance with local area policy. This equipment may be called for as necessary to assist in the treatment and evacuation of a patient (see Communicate injury severity in chapter 4).

Patroller first aid kit

Patrollers are required to have a first aid kit that must be worn, or be readily available, whenever the CSP national uniform upper body garment is worn. The first aid kit is required to provide immediate first aid service to a patient but is not a uniform component. The patroller first aid kit may be carried in a waist pack, backpack or vest.

Backpacks and waist packs should be predominately black, but may contain some red, depending on style and manufacturer. The backpack must be tagged with a white cross on the back.

A waist pack may feature a white cross or a screened outline of a white cross. A shoulder harness that obscures the official logo must not be used.

The colour of a vest must be predominately red, but may contain some black, depending on style and manufacturer. The vest must be tagged with a white cross on the back and allow for the application of the official embroidered name tag on the front left breast.

First aid kit contents

The patroller's first aid kit should contain at least the following supplies:

- 4 pairs disposable examination gloves, non-allergenic, powder free
- 1 resuscitation barrier device, with one-way valve
- 10 individually packaged antiseptic cleansing towelettes
- 25 individually packaged sterile adhesive dressings, in a variety of sizes and shapes
- 10 individually packaged 10 cm x 10 cm sterile gauze pads
- 2 individually packaged 10 cm x 10 cm sterile compress dressings with ties (equivalent bandages and dressings may be used)
- 2 individually packaged 15 cm x 15 cm sterile compress dressings with ties (equivalent bandages and dressings may be used)
- 1 20 cm x 25 cm sterile abdominal dressing
- 1 sterile dry eye dressing
- 2 conform gauze bandages, 75 mm wide
- 1 crepe tension bandage
- 4 cotton triangular bandages

- 5 safety pins, assorted sizes
- 1 roll adhesive tape, 25 mm x 4.5 m
- 1 pair of scissors (not pointed)
- 1 tweezer
- 1 waterproof waste bag
- 1 pencil, or a pen that will not freeze or be affected by wetness
- 1 small notebook
- 1 non-metallic whistle

Additional items that may be carried with your patroller first aid kit according to personal preference, the type of patrolling performed, or local area policy, may include:

- small splints, for example folding mesh splints
- oropharyngeal airways (OPAs)
- sunscreen
- a thermal blanket
- sun and wind protection
- a small folding saw for cutting branches
- rope or pieces of cord
- tags for tagging the patient's equipment
- ski wax
- wooden matches in a waterproof container
- small tools, for example: pliers, screwdrivers, adjustable wrench. Note: these tools must not be used to adjust anyone else's ski/snowboard equipment.

2. Anatomy and physiology

Learning outcome:

Describe and understand the anatomy and function of the systems of the body.

Upon completion of this chapter you should be able to:

1. Define the terms anatomy and physiology.
2. List the major systems in the body.
3. Define commonly used anatomical terms.
4. Describe the purpose and components of the musculoskeletal system.
5. Describe the structure and function of the various systems of the body.

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- Circulatory system 26
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The body

As a patroller, your responsibility is to assist an injured or sick person. A basic understanding of human anatomy and physiology is essential. Because you will communicate with other pre-hospital care workers, it is important to know the terminology used to describe aspects and components of the human body.

The human body is a complex organism composed of billions of cells working together in an organized manner for the benefit of the whole system.

The cell is the fundamental unit of structure and function. Cells are grouped into tissues, tissues into organs, and organs are grouped into systems. The entire collection of systems becomes the organism known as a human being.

Cells

Cells use oxygen (O_2) and glucose (sugar) to produce the energy they need to survive, function and produce heat. Glucose penetrates the cell membrane with the help of insulin. Insulin is a hormone produced by the pancreas. Without sufficient insulin, glucose fails to penetrate the cell membrane; less energy is produced and cells cannot function as they should.

Brain cells are an exception: glucose can penetrate these cells without insulin.

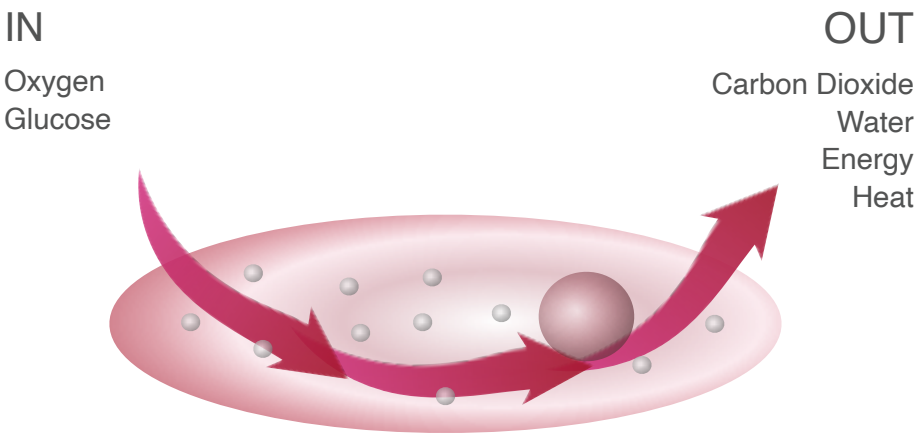

Figure 2-1: Cellular respiration (metabolism)

Anatomy

Anatomy is the study of the body's structure describing the size, shape, construction and positions of its various parts.

The reference point for describing structures of the body is called the anatomical position. Picture the body facing forward, feet together, arms to the side, and the head, eyes and palms facing forward.

Anatomical terms are always referenced to the patient's left or right side.

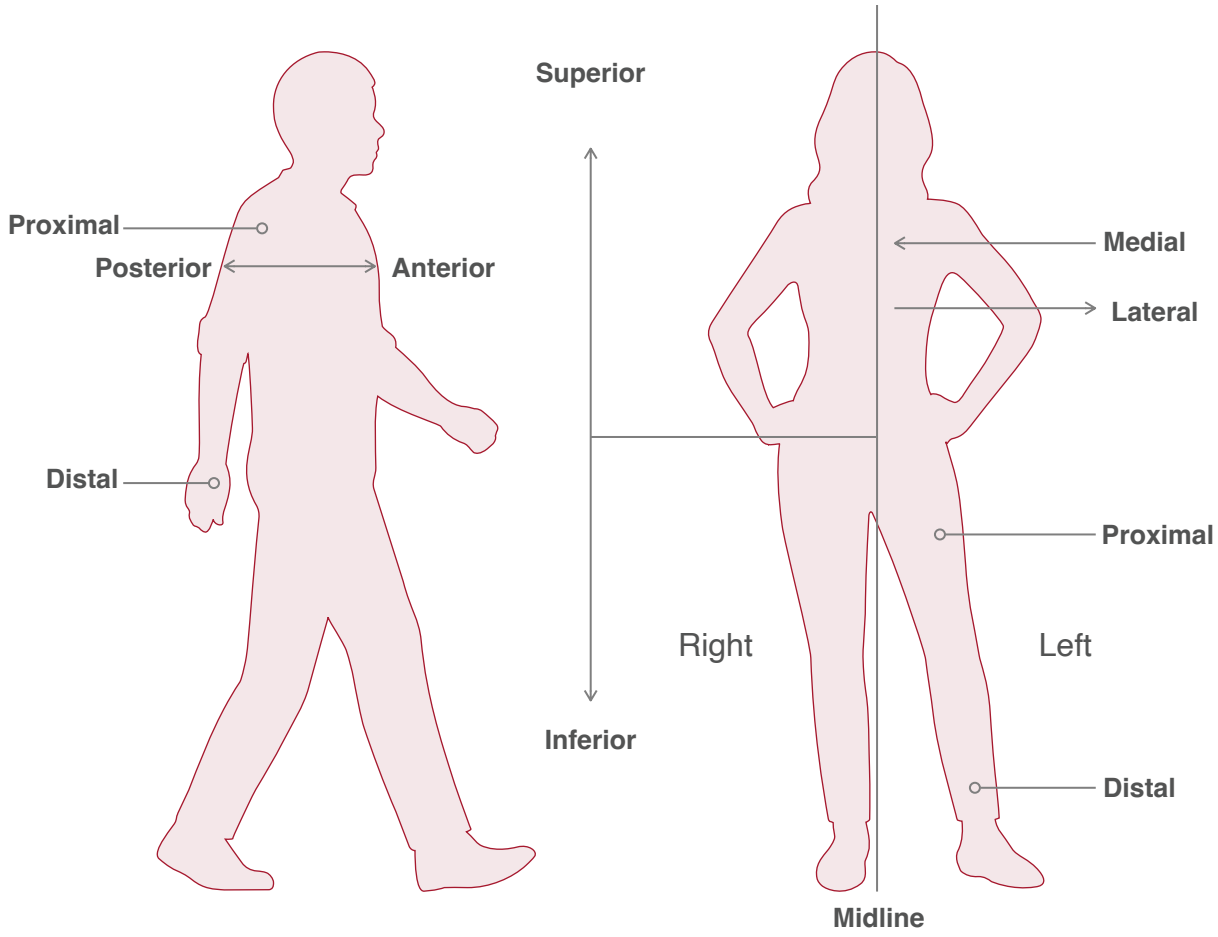

Figure 2-2: Anatomical terms.

Figure 2-3: Supine - Lying face up on the back.

Figure 2-4: Prone - Lying face down on the chest.

Figure 2-5: Semi-prone - (also known as three-quarters prone or recovery position): Lying face down, on one side.

Physiology

Physiology is the study of how the body's systems function and their relationship to the whole. In many cases, systems are closely related. Damage to one often affects others.

Seven major systems of the body

Musculoskeletal system

The musculoskeletal system represents the human skeleton consisting of bones, joints, muscles and connective tissues. Bones provide the framework and support for the body; muscles provide the motor power. Bones are connected to each other by joints and ligaments. Skeletal muscles are attached to the bones by tendons.

Bones

There are 206 bones in the normal skeleton. They:

- protect internal body organs
- provide shape or a framework to keep the body supported
- produce red blood cells
- provide storage for mineral salts, such as calcium

Types of bones

The four principal bone types are long, short, flat and irregular.

Long or tubular bones

Found in the arms and legs. They act as levers and support movement.

Short bones

Found in the wrists and ankles. They permit flexibility and movement without loss of strength.

Flat bones

Such as the sternum and ribs, protect cavities containing body organs.

Irregular bones

Do not fit into the above categories, such as vertebrae and the jawbone. They serve complex roles in muscle attachment and movement.

Structure

Bone is constructed of several different cell layers.

Periosteum

The outer layer, the periosteum, is a thin, tough membrane of fibrous tissue that covers the outer surface of a bone except at the joint ends where there is a layer of cartilage.

The periosteum serves as a protective sheath for the bone and provides an anchoring surface for the tendons.

The periosteum has many nerve fibres. Consequently, when it is injured, the patient experiences intense pain.

Cartilage

Cartilage is a type of connective tissue. It is a smooth, firm cushion that allows the joints to move without friction. Cartilage lacks direct blood supply and derives nutrition from joint fluids. It is compressible.

Cortical and cancellous bone

Beneath the periosteum lie dense, hard layers of bone tissue called cortical or compact bone. This tissue has a complex structure (it is not simply solid) and gives bone its resilience. Underlying the cortical bone, there is a latticed layer called cancellous bone. The innermost portion of the bone is a hollow cavity containing marrow.

Marrow

Marrow is a network of blood vessels and special connective fibres holding together a composite of fat and blood cells.

Red blood cells, white blood cells and platelets are formed in the red marrow. Yellow marrow, common in the central cavity of adult long bones, has no blood-producing function.

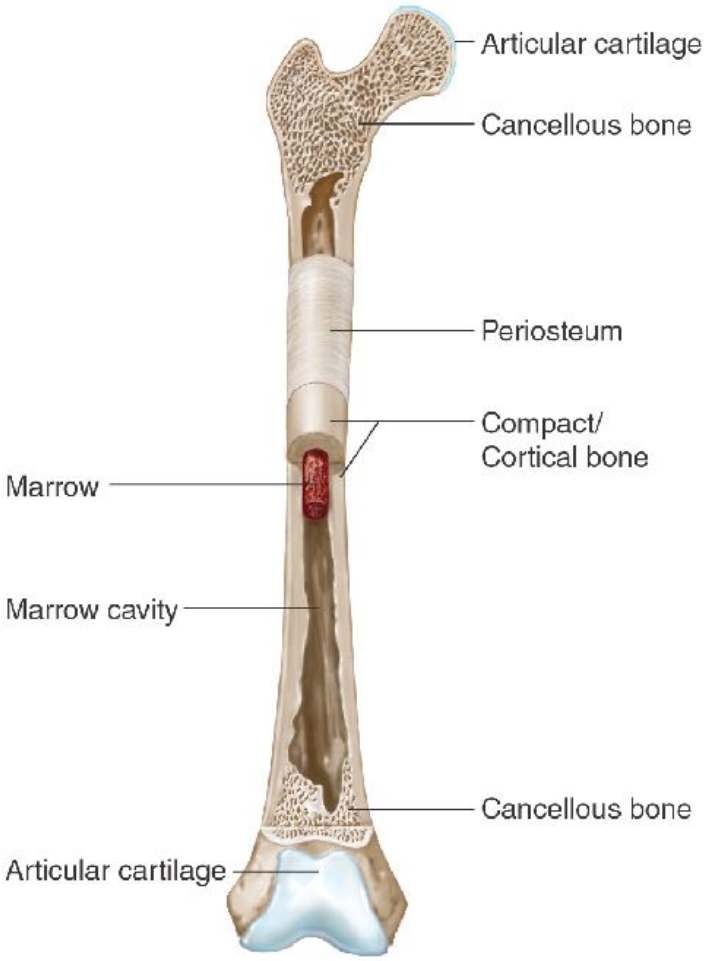

Figure 2-6: Bone structure

Skeleton

The skeleton is made up of the following groups:

- skull
- spine
- shoulder girdle
- rib cage
- upper extremities
- pelvis
- lower extremities

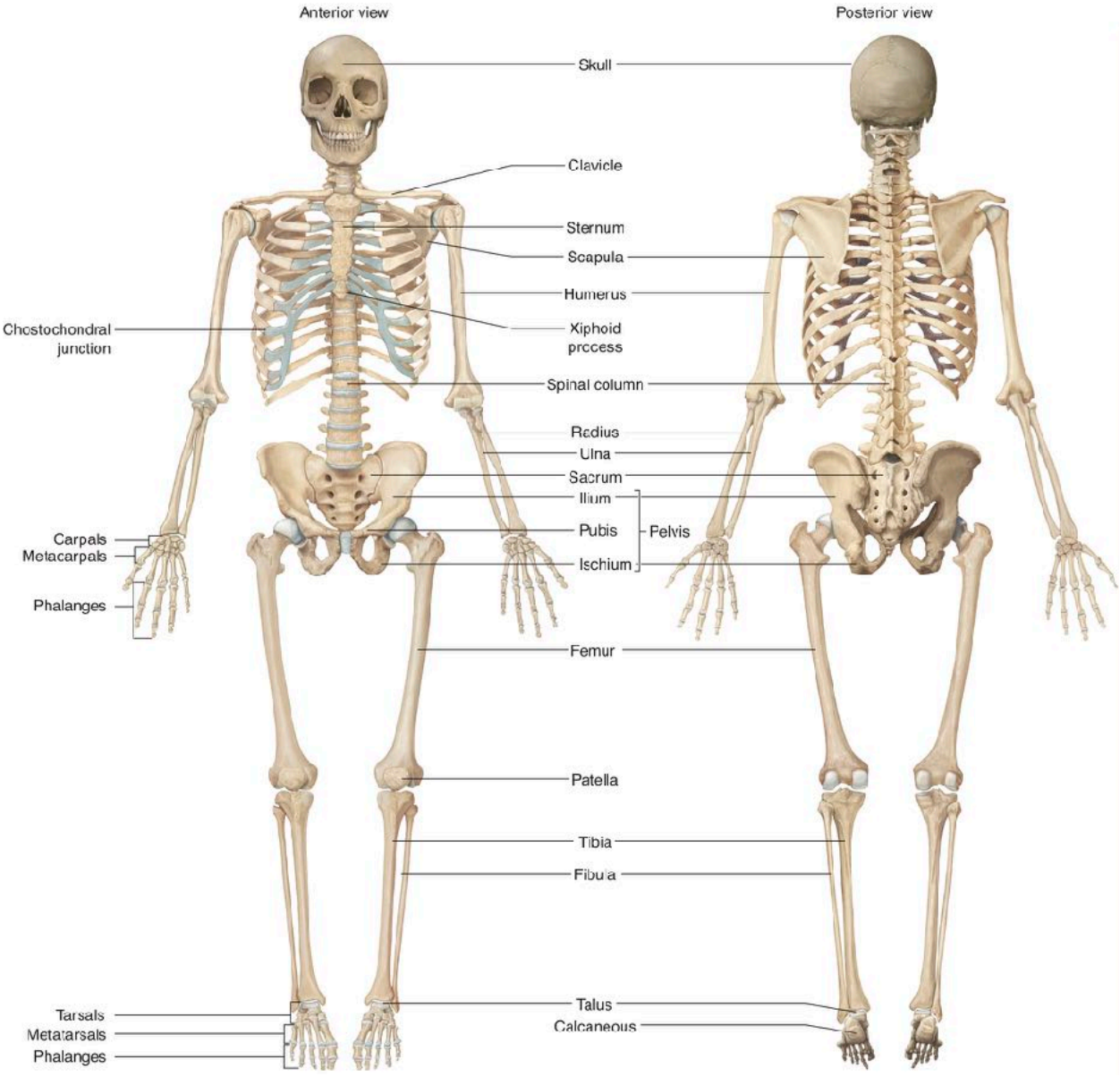

Figure 2-7: Skeleton

Skull

The skull is made up of 22 bones and consists of two parts, the cranium and the face. The cranium encloses the brain and protects it from injury. It also serves as an attachment for muscles. Facial bones form the upper jaw and cavities for the nose and eyes; the lower jaw is moveable and is connected to the skull by strong ligaments.

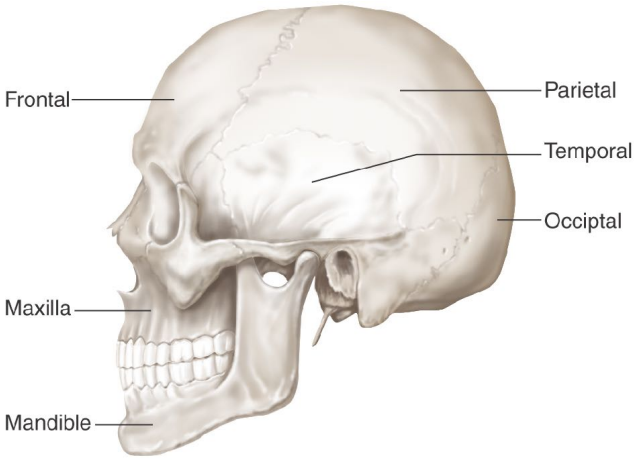

Figure 2-8: Skull

Spine and vertebrae

The spine is the principal support of the body: ribs extend from it, and the rest of the skeleton is directly or indirectly attached to it. The spine is composed of 33 bones, called vertebrae.

Individual vertebrae are separated by discs. They serve as shock absorbers and allow for limited movement. The spinal column provides protection for the spinal cord.

Shoulder girdle

The shoulder girdle is composed of the:

- clavicles (collarbones)
- scapulas (shoulder blades)

Rib cage

Ribs are flat bones attached to the spinal column. They form a cavity (cage) to protect the heart and lungs.

Rib attachment, spinal column, sternum and xiphoid process

Every rib is attached to the spinal column at the thoracic vertebrae.

The highest seven pairs of ribs are attached to the sternum by cartilage (costochondral junction). The next three pairs of ribs are joined by a common cartilage attached to the seventh rib cartilage, which is in turn attached to the base of the sternum. The lowest two pairs of ribs are

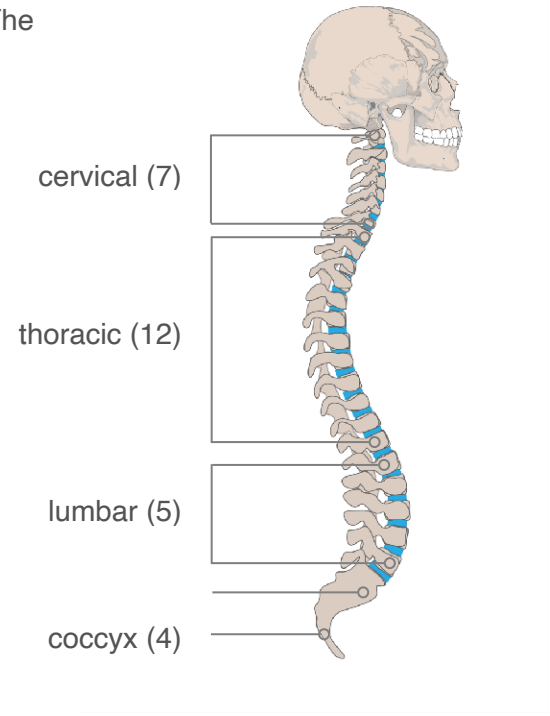

Figure 2-9: Vertebrae

floating ribs. They are the shortest ribs and have no attachment to the sternum.

The sternum, often called the breast bone, forms the middle part of the front of the rib cage. The xiphoid process forms the inferior end of the sternum.

Upper extremities

The upper extremities consist of the:

- upper arms
- lower arms (forearms)
- wrists, hands and fingers

The upper arm consists of a single long bone called the humerus.

The lower arm (forearm) consists of two long bones:

- the radius, on the thumb side of the lower arm
- the ulna, on the little finger side

The wrists, hands and fingers are composed of short and long bones. Respectively, they are the:

- carpals
- metacarpals
- phalanges

Pelvis

The pelvis serves as an attachment for muscles, supports body weight and protects major organs. The pelvic skeleton is formed posteriorly by the sacrum and the coccyx, and laterally and anteriorly by a pair of hip bones. Each hip bone has three sections: the ilium; the ischium; the pubis.

The hip bones are joined together at the front by cartilage and at the rear to the sacrum by very strong ligaments.

Lower extremities

The lower extremities consist of the:

- thigh bones (femurs)
- knee caps (patellas)
- long lower leg bones (tibias and fibulas)
- ankles, feet and toes

The thigh bone (femur) is the longest bone in the body and forms the upper leg. Proximally, its head fits into a socket in the pelvis to form the hip joint. The shaft of the bone is strong and surrounded by heavy muscles. Distally, the femur broadens to form the upper part of the knee joint.

The knee cap (patella) is a flat, triangular shaped bone. The patella lies in front of the knee joint and helps protect it.

The lower leg bones (tibia and fibula) are the long bones that form the lower leg.

The fibula is the smaller bone which distally forms the lateral prominence of the ankle joint.

The tibia is the larger, stronger bone which forms the lower half of the knee joint, the shin and the medial prominence of ankle joint.

The ankle, foot and toe bones are composed of short and long bones. Respectively, they are the:

- tarsals

- metatarsals
- phalanges

Joints

Joints occur where two or more bones come together. They are classified according to their structure and the amount of movement they permit. Bones are held together at a joint by fibrous bands called ligaments. (See "Ligaments") Every joint has a capsule surrounding it and an inner lining called synovial lining. Movable joints allow for change of position and motion. The two most common are the ball and socket joint, found in the shoulder and hip and the hinge joint, found in the elbow, knee or finger.

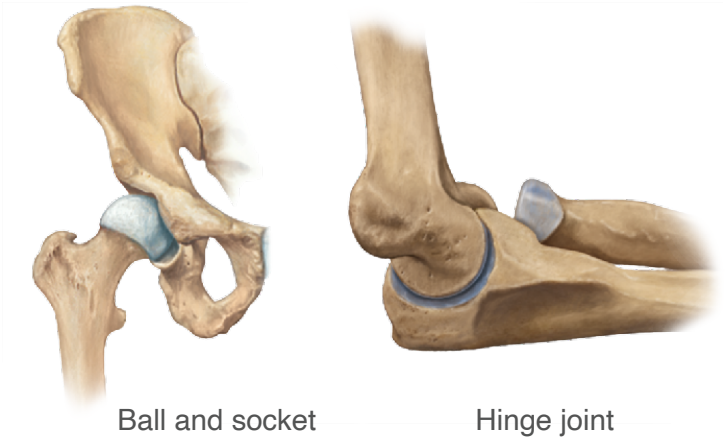

Figure 2-10: Movable joints

Muscles

Muscles provide movement, maintenance of posture, production of heat and protection to internal organs. They have the ability to contract and relax. They must have oxygen and glucose to function.

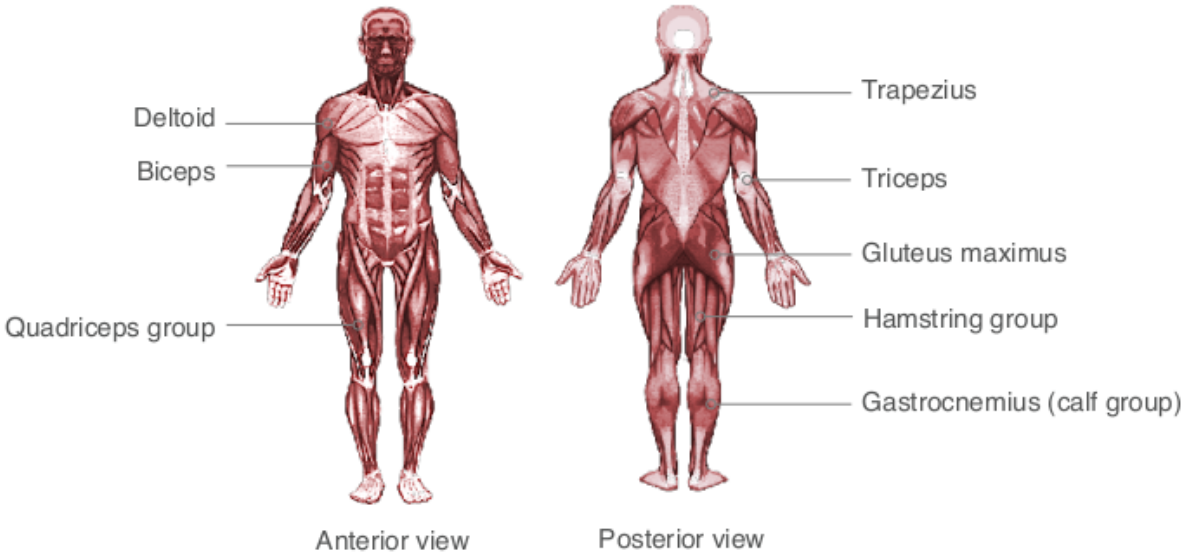

Figure 2-11: Muscles of the body

Muscles are divided into three groups:

- skeletal (voluntary)
- smooth (involuntary)
- cardiac

Skeletal or voluntary muscles are attached to the bones by tendons. Muscles of this group, such as those of the arms and legs, contract under conscious, voluntary control.

Smooth or involuntary muscles are made of longer fibres and are under the control of the autonomic nervous system. Muscles of this group are found in the walls of tube-like organs, ducts and blood vessels.

The cardiac muscle is also an involuntary muscle. It is a special type of muscle that is only found within the heart. The cardiac muscle is the only muscle that can contract on its own, that is, without a signal from the brain.

Connective tissues

The connective tissues main functions are:

- structural support
- immunological barrier
- energy storage
- water storage

Connective tissue comes in different forms and configurations throughout the body. It is made up of the following components:

- cells
- fibres
- ground substance

Together, fibres and ground substance make up what is known as the extracellular matrix. The extracellular matrix makes up most of the volume of connective tissue.

Types of connective tissues:

Fascia

An individual skeletal muscle is separated from adjacent muscles and held in place by layers of fibrous connective tissues called fascia. This connective tissue may project beyond the end of its muscle fibres to form a cord-like tendon.

Fibres in a tendon intertwine to attach the fibres of the muscle to the bone. In other cases, the fascia associated with a muscle may form broad, fibrous sheets called aponeuroses, which may be attached to the coverings of the adjacent muscles.

Each muscle fibre within a fascicle is surrounded by a layer of fascia in the form of a thin, delicate covering. Thus, all parts of a skeletal muscle are wrapped in layers of fascia, allowing parts to have independent movement. Many nerves and blood vessels also pass through the layers.

Tendons

A tendon is a durable, fibrous connective tissue. It attaches muscles to bones and other structures. For example, fingers do not have any muscles within them; their movements are effected by tendons, which extend back to muscles within the forearm.

Ligaments

A ligament is a tough band of white, fibrous, slightly elastic tissue. Ligaments are an essential part of the skeletal joints, binding the bone ends together to prevent dislocation and excessive movement that might cause breakage. Ligaments also support many internal organs, including the uterus, the bladder, the liver and the diaphragm. Ligaments also help shape and support the breasts.

Respiratory system

The respiratory system is responsible for the exchange of gases between the body and the environment. In conjunction with the circulatory system, it supplies oxygen to the body tissues, and helps in the removal of carbon dioxide, which is a waste product, from the body's tissues. Normal respiration requires five conditions:

1. A supply of normal air.
2. A clear airway.
3. The mechanical bellows function of the rib cage and diaphragm must be intact and contain at least one functioning lung.
4. The control system, including the brain, must be intact and able to respond to changing carbon dioxide levels in the blood stream.
5. An adequate blood supply with proper circulation by the heart.

Anatomy of the respiratory system

The anatomy of the respiratory system consists of the lungs and the airway.

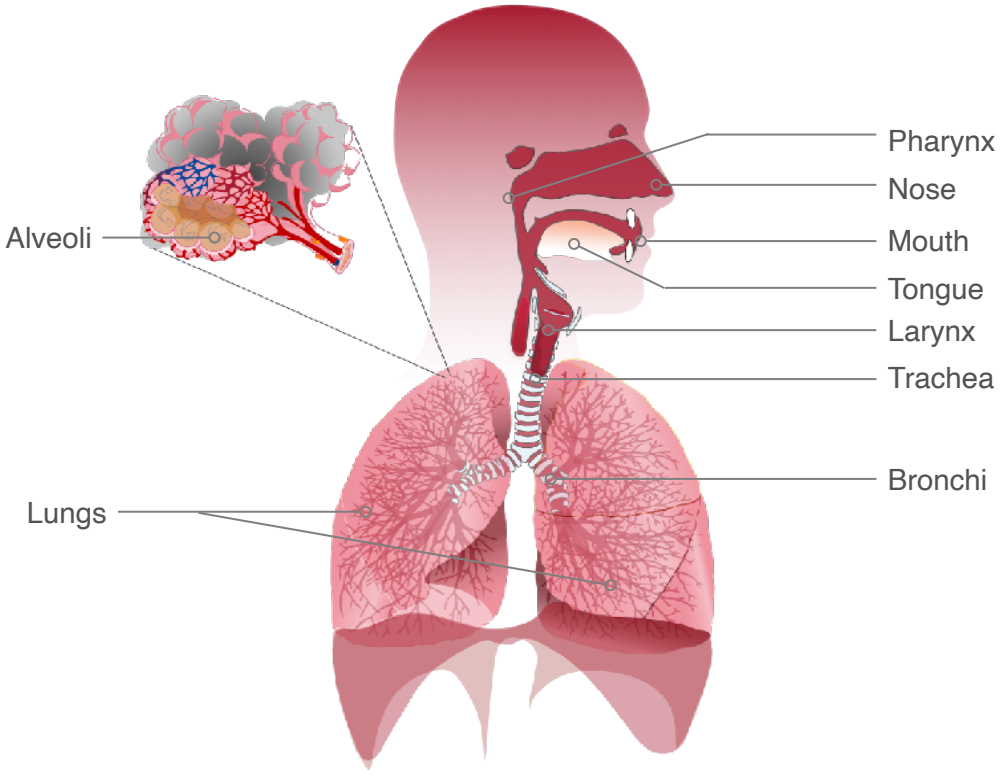

Figure 2-12: Respiratory system

Breathing is a gaseous exchange. The air we breathe in and out is made up of several gases as described below:

We inhale	We exchange	We exhale
78 per cent nitrogen	0 per cent	78 per cent nitrogen
21 per cent oxygen	5 per cent	16 per cent oxygen
0.03 per cent carbon dioxide	4 per cent	4.03 per cent carbon dioxide
Trace water vapour	<1 per cent	<1 per cent trace water vapour
<1 per cent noble (inert) gases	0 per cent	<1 per cent noble (inert) gases

Mechanics of breathing

The exchange of oxygen and carbon dioxide in the body's cells and the passage of air in and out of the lungs is called respiration. Breathing in is called inspiration or inhalation; breathing out is called expiration or exhalation.

Breathing is an active function that requires muscle action. Without brain function no breathing is possible except by an artificial method.

The act of breathing may be compared to the action of a bellows with a partially filled balloon inside. The rib cage and diaphragm act as the bellows. The lungs respond passively, acting as the partially filled balloon inside the bellows.

The lungs are surrounded by a double-layered sac called the pleura. The pleura's outer layer is attached to the ribs and completely lines the chest cavity. The inner layer surrounds and is attached to the lungs. Maintaining a vacuum in the space between these layers - the pleural space - is critical to respiration.

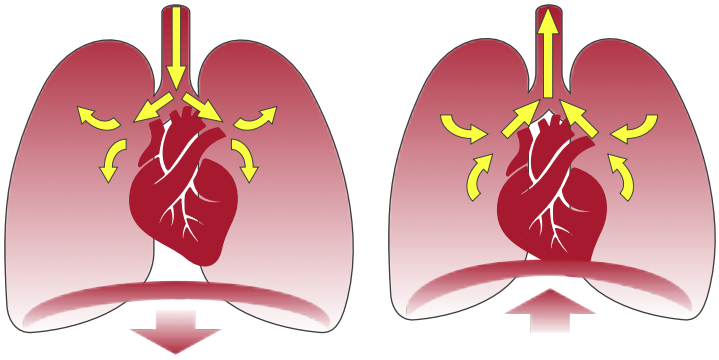

Figure 2-13: Inspiration (inhalation) and expiration

Inspiration

Inspiration (inhalation) is an active function. The rib muscles contract raising the ribs and expanding the chest. The diaphragm muscle also contracts and flattens out resulting in an enlarged chest cavity. As the chest cage becomes larger, the lungs expand.

During normal inspiration with no injuries, the diaphragm muscle is responsible for the movement of two-thirds of volume of air exchanged into the lungs; the rib muscles for one-third. During inspiration:

- The chest cavity enlarges.
- The air pressure within the chest falls, and more air rushes into the lungs.

Expiration (exhalation)

Expiration (exhalation) is normally a passive function and requires no muscular exertion. On expiration, the rib muscles and diaphragm relax.The chest then recoils to its original shape causing air to be expelled from the lungs.

Any hole in the chest wall will destroy the vacuum inside and the lung will collapse because of its elastic nature and the effects of the pressure differential. (See Chest Injuries in Chapter 8).

The mechanics of breathing are under the autonomic control of the brain.

Signs of normal breathing

There are three key signs of normal breathing:

- the rise and fall of the chest or abdomen
- evidence of air moving in and out of the lungs
- a regular rate and rhythm

Circulatory system

The circulatory system has two major fluid transportation systems:

- the cardiovascular system
- the lymphatic system

The cardiovascular system, which includes the heart and blood vessels, transports blood to all parts of the body.

Blood flowing through this circuit brings oxygen, nutrients and other chemical elements to tissue cells. It also removes carbon dioxide and other waste products resulting from cell activity.

The lymphatic system provides drainage for tissue fluid found outside the cardiovascular system. It is an auxiliary part of the circulatory system; it returns an important amount of tissue fluid to the bloodstream through its own system of lymphatic vessels.

The lymphatic system is also active in the control of infection.

Cardiovascular system

The cardiovascular system consists of:

- the heart
- blood vessels

The heart

The heart is a muscular organ that acts as a pump to maintain circulation of blood throughout the body.

It is situated just above the diaphragm. It lies in front of the esophagus and trachea – the tubes that lead to the stomach and the lungs respectively– and is protected by the rib cage. The heart is surrounded by a membrane, called the pericardium.

Blood vessels

The body of an average adult contains approximately 100,000 km of blood vessels. These blood vessels are divided into three types:

- arteries
- capillaries
- veins

Arteries

The arteries are thick-walled, elastic vessels which carry blood away from the heart. The elastic nature of these vessels helps to even out the blood pressure between heart beats and also causes them to retract and constrict when severed.

Arterial blood is usually bright red as a result of the presence of oxygen which has combined with the hemoglobin in the red blood cells. Arterial bleeding flows in spurts and may be profuse.

Capillaries

Arteries subdivide into smaller vessels called arterioles which in turn subdivide into very small, thin-walled vessels called capillaries. The exchange of oxygen, carbon dioxide and other materials to and from the cell takes place through these thin walls.

Capillary blood will ooze very slowly from a superficial wound, such as an abrasion. It is seldom life-threatening.

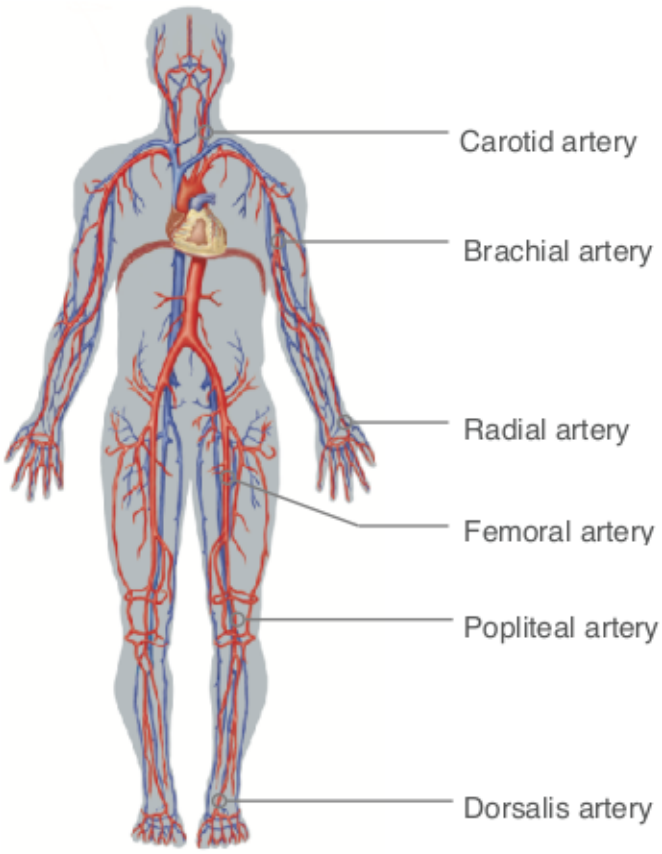

Figure 2-14: Circulatory system

Veins

Veins are thin-walled vessels that return the blood to the heart through gravity or muscle action. The pressure of the blood in veins is lower than in arteries. Veins have one-way valves within them so that blood cannot flow backward.

Venous blood has a darker, more purplish hue since some of the oxygen has been exchanged for carbon dioxide and other wastes. Venous blood tends to flow in a steady stream from a wound. Bleeding may be very heavy if a large vein is cut.

Circulatory and cardiac cycle

Pulmonary circulation provides circulation through the lungs whereas systemic circulation provides circulation through the rest of the body. In both systems, blood flows from the heart, through arteries, into capillaries then veins and finally returns to the heart.

Pulmonary circulation

Pulmonary circulation starts with the contraction of the right atrium of the heart, forcing blood into the right ventricle. Contraction of the right ventricle forces blood into the pulmonary artery and through the lung capillaries. In the lungs, carbon dioxide in the blood is exchanged for oxygen from the inhaled air.

Once enriched with oxygen, the blood returns via the pulmonary vein to the left atrium of the heart to begin the systemic circuit. The blood is now bright red.

Systemic circulation

Systemic circulation starts with the contraction of the left atrium of the heart, forcing blood into the left ventricle. Contraction of the left ventricle causes the blood to flow through the aorta into the arteries of the body. The arteries divide into smaller and smaller branches, finally forming the thin-walled tiny capillaries. The capillary walls readily allow interchange between the blood and body cells. Oxygen, water and nutrients pass from the blood into the cells of the body. Carbon dioxide and other waste products are passed from the cells into the blood to be carried away for elimination.

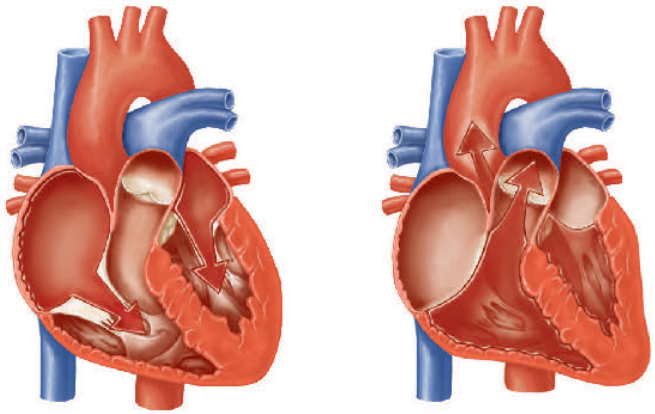

Figure 2-15: Atrial contraction and ventricle contraction

Pulse

The pulse is the pressure wave caused by the contraction of the heart which forces the blood through the arteries. The best points at which to feel the pulse are where the arteries lie near the surface of the body, and near a bone or hard surface against which pressure may be applied.

Pulse rates vary considerably as a result of different factors such as age, activity, emotional response, injury, physical conditioning, disease, medication, or environmental conditions (see Pulse in Chapter 4).

Blood pressure

At each heart contraction, the arteries expand and absorb the momentary increase in blood pressure. As the heart relaxes in preparation for another beat, the aortic valves closes to prevent blood from flowing back to the heart chambers and the arterial walls spring back, forcing the blood through the body between contractions.

In this way, the arteries act as dampers on the pulsations and provide a steady flow of blood through the blood vessels. Because of this, there are actually two blood pressures within the blood vessels during one complete heartbeat:

- the systolic or higher pressure upon ventricular contraction
- the diastolic or lower pressure during cardiac relaxation

Blood pressure is usually referred to as the systolic value over the diastolic in millimetres of mercury. For example, a typical adult blood pressure reading might be “120 over 80.” Blood pressure can vary considerably between individuals depending on the time of day it is measured, activity or emotions the individual is experiencing.

A systolic pressure of at least 80 is assumed when a radial pulse can be felt, 70 with a femoral pulse, and 60 with a carotid pulse.

The lymphatic system

The lymphatic system consists of lymphatic capillaries, vessels, glands, ducts, and the spleen. From a first aid standpoint, the most important of these organs is the spleen.

Spleen

The spleen is located under the ribs in the upper-left quadrant of the abdomen. It is an encapsulated, oblong, flat, dark red organ that is smaller than the liver.

One major function of the spleen is to act as a storage reservoir for blood cells. If it is ruptured a massive blood loss – hemorrhage – will occur and can be life threatening.

During the circulatory process, plasma – a component of the blood – escapes through the capillary walls carrying nutrients and oxygen to the body cells. After the plasma (see Blood, below) has completed its function, most of it passes back through the capillary walls into the blood stream. However, some plasma – the lymph – is collected in a second set of vessels which make up the lymphatic system.

Composition of blood	
Plasma	55 per cent
Red blood cells (99 per cent) White blood cells and platelets (1 per cent)	45 per cent

Red blood cells

These are formed in the red bone marrow and contain hemoglobin. Hemoglobin transports oxygen from the lungs to other organs throughout the body. Red blood cells are found in the spleen which acts as a reservoir for the blood system and discharges the cells into the blood as needed.

White blood cells

These are the body's primary defence against infection. They can move under their own power, are larger than red blood cells and fewer in numbers. White blood cells rapidly increase in numbers when bacteria and viruses invade the body. They migrate quickly to the site of the infection, where they attack and attempt to overwhelm the foreign substance.

Platelets

These are tiny, about one-third the size of red blood cells. They are disc-like in shape and are responsible for the initiation of clotting.

Plasma

A proteinaceous substance in which the other three elements circulate. It constitutes over half the blood volume. In itself, plasma is comprised of about 92 per cent water, 7 per cent protein, and 1 per cent other substances. The "other substances" in plasma have functions related to:

- nutrition of cells
- disposal of wastes
- transport of gases
- glandular secretions
- the transport of cells that fight disease

Functions of blood

The primary functions of blood are to:

- transport nutrients from the digestive system to all other parts of the body
- transport oxygen from the lungs to cells and carbon dioxide from cells to the lungs
- help the body get rid of other wastes from cells through the kidneys
- regulate and coordinate body processes through the transportation of hormones
- aid in the regulation of water distribution throughout the body
- maintain the body's temperature by circulating heat
- defend the body against infection via the white blood cells and antibodies

Blood clotting

The purpose of blood clotting is to plug ruptured blood vessels thus preventing excessive loss of blood. Platelets trigger clotting by disintegrating as they pass over rough places on the injured surface. The disintegration process releases specialized proteins which form a jelly-like substance over the ends or within the walls of an injured vessel.

A clot will usually form within five minutes after a blood vessel wall has been damaged. If blood does not clot, a patient may bleed to death from injury.

Some males have hemophilia, an inherited condition that reduces the ability of the blood to coagulate. Other patients may take medication to deliberately inhibit the coagulation process (e.g. blood thinners to avoid cardiovascular events). One of these conditions should be suspected when blood fails to clot after five to 10 minutes. If the patient has a significant bleed that does not clot, activate EMS and treat as a Load and Go.

ABC summary: airway, breathing, and circulation

With a clear airway, breathing (respiration) exchanges carbon dioxide for oxygen. Circulation transports these gases around the body's tissues.

Oxygen and glucose are brought to the body's cells by the blood. Blood is circulated through the body by the pumping action of the heart.

The brain controls breathing. While the heart does beat by itself, the brain controls the speed. Without brain function the heart may still beat by itself as long as it receives oxygenated blood.

Blood pressure in the vessels is ensured by the pumping action of the heart, the volume of blood in the vessels and by the resistance of the blood vessels to the circulation.

The intimate interrelationship between airway, breathing, and circulation is essential to life.

Remember your ABCs: an injury to any one of these systems requires immediate action.

Nervous system

The nervous system is the major controlling, regulatory, and communication system in the body. Together with the endocrine system, it is responsible for regulating and maintaining the internal conditions of the human body. The nervous system provides precise, rapid control of muscles, organs and glands and receives tactile and other sensations. The nervous system is divided into three systems.

Central nervous system

The central nervous system consists of two joined organs, the brain and the spinal cord.

Brain

The brain is the ultimate control centre for all functions. It is a very soft organ richly supplied with blood. The brain consists of three parts:

- the cerebrum
- the cerebellum
- the brain stem

Cerebrum

The cerebrum forms the bulk of the brain, and is composed of a large number of nerve fibres (white matter) and cell bodies (grey matter). It is easily depressed by alcohol, trauma or drugs.

Cerebellum

The cerebellum is the second-largest portion of the brain. It is located below the cerebrum toward the back of the head. It is responsible for the regulation and coordination of complex voluntary muscular movement as well as the maintenance of posture and balance.

Damage to the cerebellum results in the loss of muscular coordination.

Brain stem

The brain stem is located below the cerebrum and leads to the spinal cord. It controls involuntary (autonomic) actions such as breathing, heart rate and body temperature.

Trauma, serious alcohol or drug abuse can severely damage the brain stem resulting in behavioural and functional abnormalities.

Spinal cord

The spinal cord provides two way communication between the brain and other parts of the body. The nerve bundles that make up the spinal cord cannot be repaired by the body or surgery after being severed.

Peripheral nervous system

The peripheral nervous system is made up of motor nerves, sensory nerves and autonomic nerves of which some fulfill both functions.

The motor nerves transmit commands from the central nervous system to the muscles of the periphery.

The sensory nerves transmit information from peripheral receptors to the central nervous system.

The autonomic nervous system regulates body functions.

Pain

Pain can be felt both on the surface of the body and internally. Pain sensation is transmitted to the brain via sensory nerves and the spinal cord. It is only when this information reaches a functioning brain that the pain may be felt by the individual. Pain varies in intensity depending on the individual and the degree to which the patient has been injured.

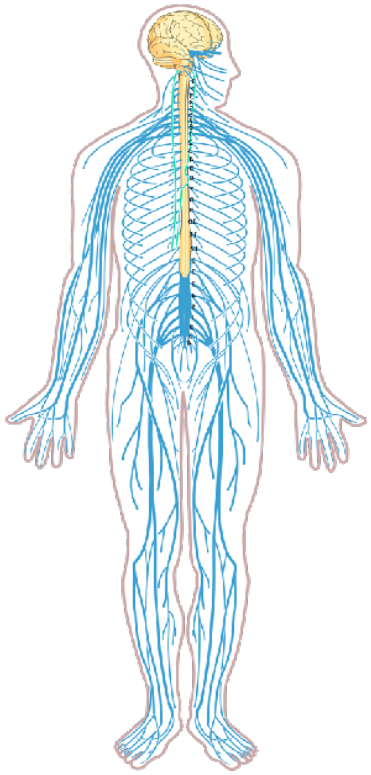

Figure 2-16: Nervous system

Autonomic nervous system

The autonomic nervous system is a group of sensory and motor nerves primarily concerned with the functioning of the organs within the chest and abdomen.

These nerves come under some control of the higher brain but normally the activity of this system does not intrude on the level of conscious awareness.

Fight or flight

The autonomic nervous system is closely associated with certain glands in the body, including the adrenal glands, that make up the endocrine system. (see "Endocrine and reproductive systems")

In response to a challenging or threatening situation, the adrenal glands release adrenalin into the blood stream. The blood stream transports adrenalin to all organs in the body where it has a wide range of effects including increased heart rate, increased blood pressure and dilated pupils.

This is sometimes referred to as the "fight or flight response." This explains some of the changes that are seen as the body is injured or is fighting off shock. (see Shock in Chapter 9)

Sense organs

Humans have five senses, with an organ responsible for each.

Senses & associated organ

CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI

Sense	Organ
Sight	Eyes
Hearing	Ear
Touch	Skin
Smell	Nose
Taste	Tongue

Eye

The eyes are sensitive indicators of oxygen supply to the brain. However, the effect of drugs or head injury can change the size and reaction of the pupils. The iris – the coloured muscles surrounding the pupils – needs the action of the brain to contract. Complete relaxation of the iris occurs when the brain lacks oxygen or has been severely injured; this is observed as a dilated pupil that does not react to light.

Tear glands beneath the upper eyelid provide tears which lubricate the eye. The tears drain through tear ducts located on the inner corner of the eye near the lower lid.

Ear

The ear has three parts: the visible outer ear, and the middle and inner ear within the skull.

The outer ear is formed entirely of cartilage with a skin covering. It focuses and directs sound into the middle ear. The middle ear transmits sound waves to the inner ear where the hearing organ is located. The inner ear also contains the organ of balance.

Skin

The skin is the largest organ of the human body. It serves three main functions:

- protects the body from the environment
- maintains nerves that convey information about the environment to the brain
- regulates body temperature

Nose

The olfactory sense – smell – uses the nose as a collector of airborne aromas. The sensitivity of this sense varies between individuals. The combination of smell and taste primes the digestive system during ingestion.

The nose is a triangular-shaped cartilage supported by the nasal bones. It protects the olfactory organs. The nose has the unfortunate combination of a rich blood supply and a prominent location on the face. The latter results in an easily injured protuberance and the former makes the misfortune obvious. Blood loss may occur externally or internally into the upper airway which may compromise breathing.

Tongue

The sense organs of taste are on the upper surface of the tongue. There are specific receptors for the qualities of sweet, bitter, sour and salty.

The tongue is richly supplied with blood vessels, which can lead to heavy bleeding if injured.

In the absence of an intact and functioning nervous system (i.e. unconsciousness), the tongue can obstruct the upper airway.

Digestive system

The main function of the digestive system and its accessory organs is to take in food and break it down into simpler molecules which can be absorbed and distributed throughout the body. The system involves two types of processes:

- The mechanical process involves chewing, swallowing and defecation of food.
- The chemical process breaks up food by various chemical reactions into simpler components for absorption and use by the body.

Anatomy of the digestive system

The digestive system contains four main organs:

- esophagus
- stomach
- small intestine
- large intestine

Other organs associated with the digestive system are the: liver, pancreas, gallbladder and appendix. Each part of the system has a rich blood supply and injury may result in severe internal bleeding.

Esophagus

The esophagus is a flexible tube leading from the pharynx in the upper throat to the stomach.

The average esophagus is about 25 cm (10 inches) long. Its wall is made of muscle fibres that contract in waves to push chewed food down to the stomach.

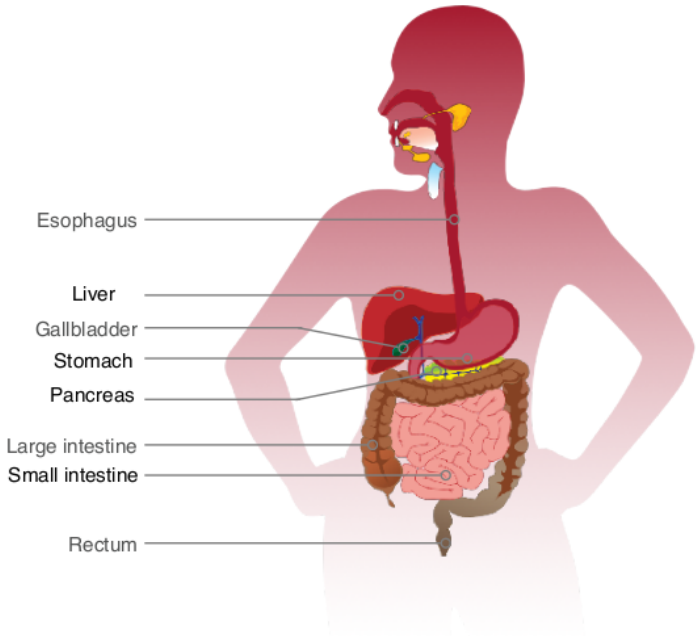

Figure 2-17: Digestive system.

Stomach

The stomach is a curved, muscular, sac-like structure that is an enlargement of the alimentary canal between the esophagus and the small intestine. It is located in the upper left quadrant of the abdomen below the diaphragm, to the right of the spleen and partly under the liver.

The stomach empties its contents in about one to four hours, depending on the type of food eaten. When empty, the stomach has practically no volume; when full, it holds about 1.5 litres.

When food enters the stomach, wavelike muscular contractions, progressing from the upper end to the lower end, mix the partially digested food with stomach secretions to the consistency of thick soup. The contractions then push the mixture into the small intestine.

Small intestine

The small intestine is about seven metres in length and 2.5 cm in diameter. Its coiled loops fill most of the abdominal cavity.

The small intestine finishes the process of digestion, absorbs the nutrients, and passes the residue on to the large intestine.

Large intestine

The large intestine forms a complete arc over and around the small intestine. It is about two metres in length and seven cm in diameter.

Liquid from the wastes reaching the large intestine is absorbed back into the body through the intestinal walls. The waste itself turns into solid feces and is pushed down the rectum for elimination.

Associated organs

Liver

The liver is a large brown gland located mainly in the upper-right quadrant of the abdomen, just beneath the diaphragm.

The liver plays a vital role in the maintenance of normal blood sugar and the conversion of food into energy. It manufactures substances important in the blood clotting process and also bile - a greenish brown fluid aiding the digestion of fats.

The liver rids the body of harmful substances in the blood and stores nutrients.

It is fragile and, if lacerated, bleeding can be severe.

Pancreas

The pancreas lies in a horizontal position in the upper quadrants below and behind the liver and the stomach. It is tubular in shape and is straw coloured.

The pancreas has two main functions:

- It secretes into the blood the hormones insulin and glucagon which are important in the control of blood sugar level.
- It secretes into the duodenum digestive enzymes and pancreatic juices which aid in digestion.

The pancreas is one of the better protected organs. If it is ruptured, painful inflammation of the peritoneum (see below) and other organs can occur.

Gallbladder

The gallbladder is a pear-shaped sac attached to the underside of the liver in the upper right quadrant. It is ten centimetres long and three cm wide.

The gallbladder serves as a storage reservoir for bile, which is used in the digestive process. It is joined to the small intestine by the bile duct.

Appendix

The appendix is a small, blind pouch near the junction of the large and small intestines, in the lower right quadrant. It is a common source of inflammation and when ruptured, becomes a medical emergency.

Peritoneum

The peritoneum is the inside lining of the abdominal wall. It is very sensitive to irritation from blood or other bodily fluids released by injury to an abdominal organ. When irritated, the peritoneum causes a guarding response of the entire abdominal wall - this indicates a potentially life-threatening injury.

Guarding can be detected by:

- non-voluntary rigidity of the abdominal wall when palpated, i.e. when examined carefully with the pads of the fingers
- pain in response to jarring movements including coughing or transportation

For example, a person with appendicitis resulting in inflammation of the appendix and nearby peritoneum, may initially have pain and guarding in the right-lower quadrant of the abdomen near the appendix. With time, this guarding will be generalized to the whole abdomen.

Urinary system

The urinary system filters and excretes wastes from the blood. It also helps maintain the balance between water and various chemicals in the body. The urinary system consists of:

- two kidneys
- two ureters
- one urinary bladder
- one urethra

Kidneys

The kidneys are two bean-shaped organs that lie on each side of the posterior abdominal cavity and are partially protected by the lower or floating ribs of the rib cage. They are described as retroperitoneal, that is, lying behind the peritoneum. Average sized kidneys are approximately 12 cm in length, five cm in width and three cm in thickness.

Kidneys regulate fluid volume and other substances in the blood, and remove wastes from the blood. The kidneys are connected to the bladder via tubes, called ureters.

Suspect kidney injury if the patient has bloody or smoky urine.

Ureters

The ureters carry urine away from the kidneys to the urinary bladder for excretion.

Urinary bladder

The bladder is an expandable and contractible sac located behind the pubic bone. The bladder is infraperitoneal, i.e. below the peritoneum.

It serves as a reservoir for urine before it leaves the body via the urethra.

Urethra

The urethra is the final passageway for the flow of urine. It is a small tube leading from the floor of the bladder to the outside of the body.

Because the urinary system organs lie outside the peritoneum, they do not trigger peritoneal irritation when injured. They can lose a significant amount of blood without generating the signs and symptoms specific to abdominal injuries: guarding, rigidity, and distention.

Carefully monitor vital signs when injuries to these structures are suspected.

Endocrine and reproductive systems

The endocrine system is a group of glands which secrete hormones into the blood. Hormones regulate metabolism, growth, reproduction and other body functions. The endocrine system includes the:

- pituitary gland
- thyroid gland
- parathyroid glands
- adrenal glands
- ovaries
- testes
- pancreas

These glands are very well protected and are normally of no concern to the first aider.

In the case of the reproductive system, emergency childbirth may be encountered (see Childbirth in Chapter 19).

Conclusion

This chapter has introduced you to basic anatomy and physiology. You now have an understanding of the body, its component parts and the interrelationship and interdependency between those parts.

This information will help you:

- Determine the nature of the injuries.
- Accurately pinpoint medical problems that require immediate medical attention.
- Communicate with emergency medical technicians efficiently.
- Make appropriate transport decisions.

3. Infectious diseases and standard precautions

Learning outcome:

Recognize the risks of infectious diseases and how to protect against them.

Upon completion of this chapter you should be able to:

1. Describe the most common exposures to infectious diseases encountered by patrollers.
2. Know how to reduce the risk of transmitting dangerous infections and the steps a patroller should take if an exposure occurs.
3. List the personal protective equipment (PPE) patrollers should carry with them and use.
4. Demonstrate the safe removal of gloves and other PPE.
5. Describe the safe disposal of contaminated materials.

In this chapter:

Exposure to infectious diseases 39
Bodily fluids and blood-borne infectious diseases 39
Signs, symptoms and transmission of blood-borne infectious diseases 39
Hepatitis 39
HIV/AIDS 40
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Exposure to infectious diseases

There are three mechanisms by which patrollers may be exposed to infectious diseases:

- Bodily fluid and blood-borne, such as hepatitis and HIV (human immunodeficiency virus) – which can progress to AIDS (acquired immunodeficiency syndrome); and
- airborne and contact, such as upper respiratory infections (colds), influenza-like illness, coronavirus (e.g. COVID-19), measles, mononucleosis, meningitis and tuberculosis.
- Penetrating wounds, which can be the result of environmental risk factors, e.g., tree limbs, or by errors in handling medical equipment such as needles or scalpels. These will not be discussed further in this chapter. If exposed to a penetrating wound medical care must be sought for professional evaluation and management.

Although the likelihood of a patroller contracting an infectious disease is slim, the risk still exists. To reduce the risk, patrollers must take “standard precautions”.

Standard precautions are guidelines to help protect you from infectious diseases and help reduce the spread of infection, from, to, or between patients, primarily through the use of effective hygiene procedures and personal protective equipment (PPE). See Standard precautions for more details.

Bodily fluids and blood-borne infectious diseases

Blood-borne diseases transmitted by direct contact with infected blood or other body fluids are often incurable and occasionally fatal. They pose a particularly high risk to patrollers. Examples include hepatitis A, B and C and human immunodeficiency virus (HIV).

Because blood-borne diseases can be transmitted from saliva-to-blood or from blood-to-blood contact, patrollers who come in contact with infected persons are at risk in the following circumstances:

- The patroller has a laceration, abrasion or other fresh injury to their skin permitting contact with the blood or bloody body fluids of an infected person.
- The patroller has an oral lesion or other injury to the mucous membrane lining of his mouth, such as a tongue bite, and gives artificial respiration to an infected person.

Generally speaking, non-bloody body fluids of an infected person pose a small risk to those with a skin break. Yet, it is impossible to guarantee that this risk does not exist. Therefore, patrollers with open sores or wounds should avoid direct contact with the body fluids of those they treat. Casual contact between infected and non-infected individuals is not dangerous.

Signs, symptoms and transmission of blood-borne infectious diseases

Hepatitis

Infectious hepatitis is caused by a number of different viruses, some of which have not yet been fully identified.

Hepatitis A and hepatitis E viruses cause fever, diarrhea, flu-like symptoms and jaundice (yellowing of the skin and eyes). These infections are not generally fatal, resolve on their own without treatment and are contracted by ingesting the virus orally.

Hepatitis B, C, and D viruses, on the other hand, are much more serious. These viruses are spread through direct contact between your bloodstream and the blood or body fluids of someone who is infected. Hepatitis B is found in saliva and other body fluids such as urine, vomitus, sputum and feces. These viruses cause an acute liver infection, marked by fever and jaundice. The infection may:

- resolve completely (go away)
- progress rapidly to total liver failure causing death
- become a chronic infection that leaves the individual without symptoms but still able to infect others

Chronic hepatitis results in cirrhosis. Cirrhosis refers to the severe scarring of the liver and can progress to liver cancer. Both cirrhosis and cancer are life threatening diseases.

Chronic hepatitis is much more common than HIV and is responsible for a greater number of deaths.

A vaccine that is more than 90 per cent effective now exists to protect individuals against hepatitis B. This vaccine is now widely used for routine childhood immunization. The hepatitis B vaccine does not prevent infections against other hepatitis viruses. It should be noted that up to 10 per cent of those who receive the vaccine do not respond to it. Nonetheless, it is strongly recommended that all health care workers receive the hepatitis B vaccine.

The CSP recommends hepatitis A and B (and C when available) vaccination for all patrollers. In many jurisdictions, this is available through public health agencies at no cost for first responders.

HIV/AIDS

Simple exposure of normal, uninjured skin to HIV infected blood has not been shown to be a risk for infection. The likelihood of a patroller contracting HIV infection through random exposure to the blood of a patient is minuscule and even more unlikely when exposed to non bloody bodily fluids.

The chance of becoming infected with HIV after being exposed to the blood of an HIV infected individual appears to be very low. It has been reported that, in more than 3,600 health care workers exposed to the blood of known HIV-infected patients through needle sticks and other incidents, the rate of infection attributable to the injury was approximately three in 1,000 or 0.3 per cent. The chance of acquiring HIV through a mucous membrane exposure appears even lower and is estimated at nine in 10,000 or 0.09 per cent.

Personal concerns

What should you do if you suspect exposure to a transmissible infection?

Suppose you are first on the scene of an unresponsive patient. The patient has just collided with a tree and is bleeding heavily from an open fracture. After donning protective gloves, ensuring the scene is safe, and confirming the patient's airway and breathing are all right, you compress the bleeding site with a dry sterile dressing only to discover that a fragment of bone has pierced the glove and punctured your skin. The patient is in his late sixties and doesn't look like someone who could have HIV or hepatitis infection.

How should you proceed?

Don't panic. Stay calm. Continue to attend to the patient as carefully as possible, but remove yourself from the rescue scene at the earliest possible opportunity when someone else can take over for you. Where the risk of exposure to blood and body fluids is present, the number of patrollers involved with the patient should be the absolute minimum.

Immediately wash off the patient's blood and then bleed out your own wound. This is accomplished by squeezing blood from the wound for five minutes. Disinfect your injury extensively with alcohol or another disinfectant.

Discretely ask the patient whether they have been diagnosed with any infections. This is highly sensitive and confidential information that must be shared only with those immediately caring for the patient. Other information relating to the patient's risk for HIV/hepatitis could be used by the physician to determine how to manage your situation but you should not seek this information directly.

Exchange contact information

Establish some way of contacting the patient, should it be necessary.

The patient has also been directly exposed to your blood and may contract a disease from you that you may not even know you have. For this reason, you must also provide your contact information to the patient and calmly explain that you believe you have contacted each other's blood in an unavoidable way and that a doctor needs to determine if there is anything further to be done.

Treatment

Contact an emergency department physician immediately to explain the situation because some protocols recommend treatment within hours. (Don't forget that the patient needs to be similarly considered.)

The emergency room physician may need to contact an infectious disease specialist for consultation and up to date information. The physician may also recommend to vaccinate you against hepatitis B and to give you temporary antibodies against this virus.

Currently, there is no prophylactic treatment for hepatitis C. For HIV, some physicians may initiate urgent treatment within hours, if they believe you were exposed to a high risk situation.

If you have contacted the patient's blood or body fluids, but not through a skin break on your body, there is generally no reason for concern or further action. However, if you are concerned, contact a physician to obtain further information.

Summary

If you think you have had a high-risk exposure to a patient's infected blood:

- Remain calm.
- Attend to the patient's priorities.
- Wash, bleed out and disinfect your wound immediately.
- Remove yourself from the scene as soon as further help arrives to the scene.
- Inform the patient that you have likely become exposed to each other's blood and exchange contact information.
- Ask the patient discretely and privately whether he or she is known to have an infectious disease. Do not share this information with anyone not immediately involved in caring for the patient.
- Contact an emergency physician immediately to explain the situation.

Airborne and contact spread infectious diseases

Airborne and contact spread infectious diseases are generally temporary illnesses that usually pose no real threat to life. However, as the COVID-19 pandemic has shown, certain airborne and contact spread diseases may pose a very real threat to life and a high risk to patrollers, not only as patrollers at the ski resort or at a non-skiing event but also as instructors or participants in a training event.

The general guidelines described in this section apply to the provision of advanced first aid to a patient in circumstances where the public health authorities have declared that there is a high risk of transmission of a potentially life-threatening infectious disease, usually described as an epidemic or pandemic (if global) situation.

The CSP will provide separate and additional specific guidelines, as required, to address the operational aspects related to on snow patrol operations, patrolling for non-skiing events and patroller training operations. The specific guidelines will be made available to all patrollers through links on the CSP website. The specific guidelines will take into account the requirements of the local provincial/territorial public health authorities for preventing the spread of infectious diseases. The specific guidelines will remain in effect until the public health authorities declare that there is no longer a high risk of transmission of a potentially life-threatening infectious disease and 'normal' operations can resume.

Signs and symptoms of airborne and contact spread infectious Diseases

During an infectious disease epidemic or pandemic your safety should always be the priority.

The possibility of transmission of infectious diseases requires that patrollers maintain a safe distance from a patient until the risk of infection can be established and minimized.

The following table provides a comparison between the symptoms of a common cold, influenza like illness and COVID-19 (source World Health Organization).

Symptoms	Cold	Influenza	COVID-19
	Gradual onset of symptoms	Abrupt onset of symptoms	Symptoms range from mild to severe
Runny or stuffy nose	Common	Sometimes	Rare
Sore throat	Common	Sometimes	Sometimes
Aches and pains	Common	Common	Sometimes
Sneezing	Common	No	No
Coughing	Mild	Common (usually dry)	Common (usually dry)
Fatigue	Sometimes	Common	Sometimes
Fever	Rare	Common	Common
Headaches	Rare	Common	Sometimes
Shortness of breath	No	No	Sometimes
Diarrhea	No	Sometimes for children	Rare

The CSP recommends seasonal influenza and COVID-19 vaccination for all patrollers.

Standard precautions

People with infectious diseases often show no signs that they are infected or may be at an earlier and asymptomatic stage of infection. Therefore, patrollers should assume that all blood and body fluids and all respiratory droplets are potentially infected and must follow the principle of standard precautions as a measure to reduce the risk of contracting or further transmitting dangerous infections.

Standard precautions refer to the routine use of PPE and other hygiene practices to avoid contact with blood and body fluids and infectious aerosol particles and to prevent their spread. These precautions are aimed at:

- Preventing contact between the blood and body fluids of a patient and the patroller's bloodstream; or
- Limiting the exchange of infectious aerosol particles between a patient and the patroller.

This is especially important if skin or mucous membrane lesions are present.

Use caution in all contacts with patients.

General precautions

The following measures are strongly recommended in order to avoid direct skin contact with the injured person’s blood or body fluids or respiratory droplets:

- Clean your hands using a hand sanitizer with at least 70% alcohol before donning PPE and when taking PPE off. If your hands look or feel dirty, or if hand sanitizer is not available, use soap and water and thoroughly clean hands for at least 20 seconds.
- Wear disposable, single use, impermeable gloves when examining any patient or when in contact with body fluids. Examination gloves offer the best protection. If they are not available, leave your ski gloves on during treatment to avoid direct skin contact with body fluids.
- Use a separate set of gloves for each person to avoid cross-contamination.
- Except when high-risk airborne or contact disease transmission conditions exist and an epidemic or pandemic has been declared, use a pocket face mask or other barrier type device wherever possible for assisted ventilations.
- Keep sharp objects such as broken glass, pen knives, pins and scissors, away from the scene. If this is unavoidable, handle them as little as possible and with extreme caution around bleeding individuals. Be sure that everyone present is aware of where they are.
- Dispose of bloody bandages in plastic bags and seal them. Soiled garments belonging to the injured person should likewise be placed in plastic bags, sealed and kept with the injured person.
- Clean up blood and body fluids spilled at the scene using detergents where feasible.
- Remove or cover bloody snow.
- Wear goggles, safety glasses or face shields when blood and body fluids or respiratory droplets cannot be controlled, e.g., spurting blood from an injured vessel, or vomiting, or coughing and sneezing.

- If possible, wear a surgical mask that protects the nose and mouth. A surgical mask should be worn in all cases when high-risk disease transmission conditions exist and appropriate physical distancing cannot be maintained.
- Dispose of sharps in approved sharps containers. Used auto-injectors and syringes should be sent in a sealed bag with the patient to a medical facility for proper disposal.

Personal protective equipment

PPE includes:

- Examination gloves
- Surgical mask
- Face shield or safety glasses
- Isolation gown
- Pocket face mask

All PPE must be changed after each patient contact.

Figure 3-1 Personal protective equipment

Examination gloves

Examination gloves are the most frequently used and are the all around best form of barrier protection. When wearing gloves:

- Do not wear jewellery that might tear examination gloves.
- Examine the gloves frequently for tears.
- When removing the first glove, grip the outside of the glove near the top and pull it off.
- Remove the second glove by sliding two fingers inside the glove and pushing down.
- Then grab the inside of the glove and pull it off.
- Place the gloves in double bags, sealing each bag; then dispose of both bags in the garbage.
- Wash your hands thoroughly with soap and water.

Examination gloves

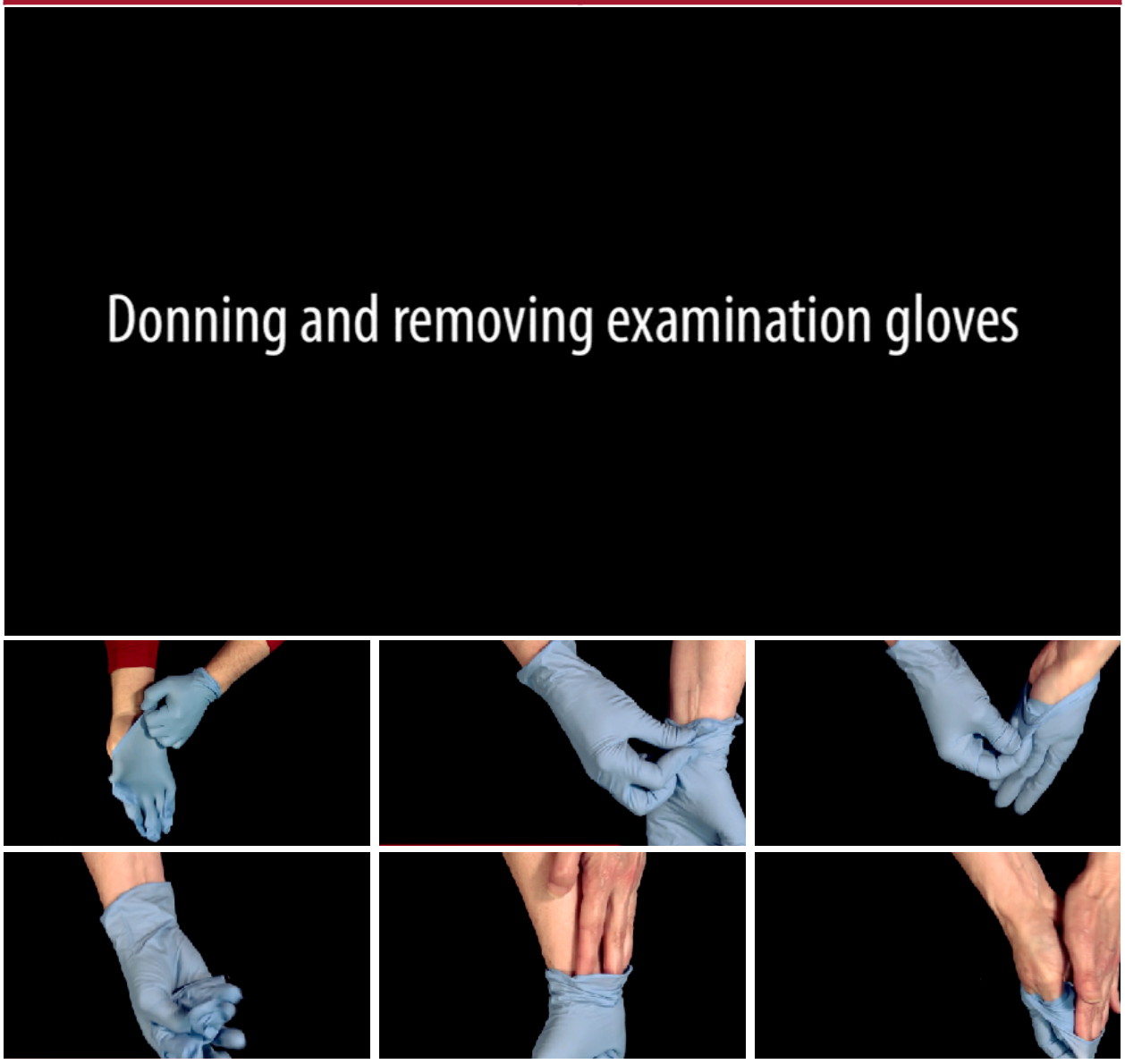

Figure 3-2: Donning and doffing Examination gloves.

Surgical masks

A surgical mask, also called a medical procedure mask, is a loose-fitting disposable mask that, if worn correctly, protects the wearer's nose and mouth from contact with liquid droplets, splashes, sprays or splatter that may contain bacteria and viruses. A surgical mask may protect others by reducing their exposure to the saliva and respiratory secretions of the mask wearer.

A surgical mask filters out large particles in the air. However, they are not designed to protect the wearer from breathing in very small particles in the air, such as airborne bacteria and viruses. Surgical masks also do not provide complete protection from germs and other contaminants because of the loose fit between the surface of the mask and the wearer's face.

Surgical masks also remind wearers not to touch their mouth or nose, which could otherwise transfer viruses and bacteria after touching a contaminated surface.

Surgical masks are usually a three-ply construction with a melt-blown polymer material placed between inner and outer non-woven fabric layers. The melt-blown polymer material acts as the filter that stops microbes from entering or exiting the mask. Pleats are commonly used to allow the wearer to expand the mask such that it covers the area from the nose to the chin. A mouldable strip along the top edge allows the mask to be moulded to the bridge of the nose and the face. The outer surface is coloured. The mask is secured to the head with ear loops, head ties or elastic straps.

Figure 3-3: Surgical mask

Eye protection

Eye protection should be worn in the form of safety glasses or a face shield.

Safety glasses, or goggles, are forms of protective eyewear that usually enclose or protect the area surrounding the eye in order to prevent particulates, water or chemicals from striking the eye. Some safety glasses may be worn over standard eyewear.

Face shields aim to protect the wearer's entire face from potentially infectious materials and can be worn over standard eyewear.

Isolation gowns

Isolation gowns are not expected to be used by a patroller in the field. However, they may be used in a medical treatment room in certain circumstances as described in the specific guidelines that may be issued for dealing with certain infectious diseases.

Pocket face masks

A pocket face mask (see Pocket face mask in Chapter 5) provides a barrier between the patroller and the injured person when providing ventilations during CPR or artificial respirations, as described in Ventilating with a pocket face mask/mask to mouth in Chapter 6.

Do not use a pocket face mask to perform mask-to-mouth ventilations when high-risk epidemic or pandemic disease transmission conditions exist.

Donning PPE

Use the following procedure when putting on (donning) your PPE:

1. Cleanse hands, preferably using alcohol-based sanitizer;
2. Put on isolation gown, if required by specific guidelines. Tie the gown at the back of the neck and waist;

3. Put on surgical mask. Secure the ties or elastic around your head so the mask stays in place. Fit the mouldable band to the nose bridge. Fit snuggly to your face and below chin;
4. Put on eye protection or face shield;
5. Put on examination gloves. If an isolation gown is being used pull the cuffs of the gloves over the cuffs of the gown.

Doffing PPE

Use the following procedure when taking off (doffing) your PPE:

1. Take off examination gloves;
2. Cleanse hands, preferably using alcohol-based sanitizer;
3. Take off isolation gown, if worn. Carefully unfasten ties. Grasp outside of the gown at the back of the shoulders and pull the gown down over the arms. Turn the gown inside out during removal. Put in laundry hamper if reusable, or in garbage if disposable;
4. Cleanse hands, preferably using alcohol-based sanitizer;
5. Take off eye protection or face shield. Handle only by headband or ear pieces. Carefully pull away from face. Put reusable items in appropriate area for cleaning. Put disposable items in garbage.
6. Take of surgical mask. Bend forward slightly and carefully remove the mask from your face by touching only the ties or elastic bands. Start with the lower band and then the upper head band. Throw the mask in the garbage.
7. Cleanse hands, preferably using alcohol-based sanitizer.

Conclusion

The risk of exposure to life-threatening infections in the performance of regular duties is minimal. Nonetheless, any unprotected contact with the blood or respiratory droplets of another person can be potentially dangerous. Measures should always be taken to minimize this risk.

- Understand that the risk of contracting hepatitis or HIV infections following contact with the blood or bodily fluids of infected individuals is small but not zero.
- Understand that the risk of contracting coronavirus infections, such as COVID-19, or other high risk airborne or contact diseases during an epidemic or pandemic is elevated.
- Use of barrier protection (gloves, pocket face masks and impermeable coverage of skin lesions) when dealing with blood and body fluids will substantially reduce the risk of infection.
- Use barrier protection (gloves, surgical masks, eye protection) when dealing with potentially infected respiratory droplets.
- Avoid sharp objects in the presence of body fluids, and know how to respond when you have come into contact with body fluids.

4. Patient assessment

Learning outcome:

Know how to safely approach an incident scene; assess a patient (or patients) and record results; assess the patient's injury and/or medical condition; consider the treatment for the injury and/or medical condition; and, in a timely manner determine and communicate the need for further assistance, method and urgency of transport to the next level of care.

Upon completion of this chapter you should be able to:

1. Perform a scene survey and communicate appropriately.
2. Perform primary and secondary assessments on a simulated patient while verbalizing what is found (look and feel) at each stage of the assessment.
3. Make and communicate a transportation decision based upon the clinical severity of the patient.
4. Perform the measurement of all vital signs.
5. Describe the CSP pain management protocol.
6. Describe the application of the Simple Triage And Rapid Treatment (START) system for multiple patient situations.

When reviewing this chapter, it is helpful to have the patient assessment checklist for reference.

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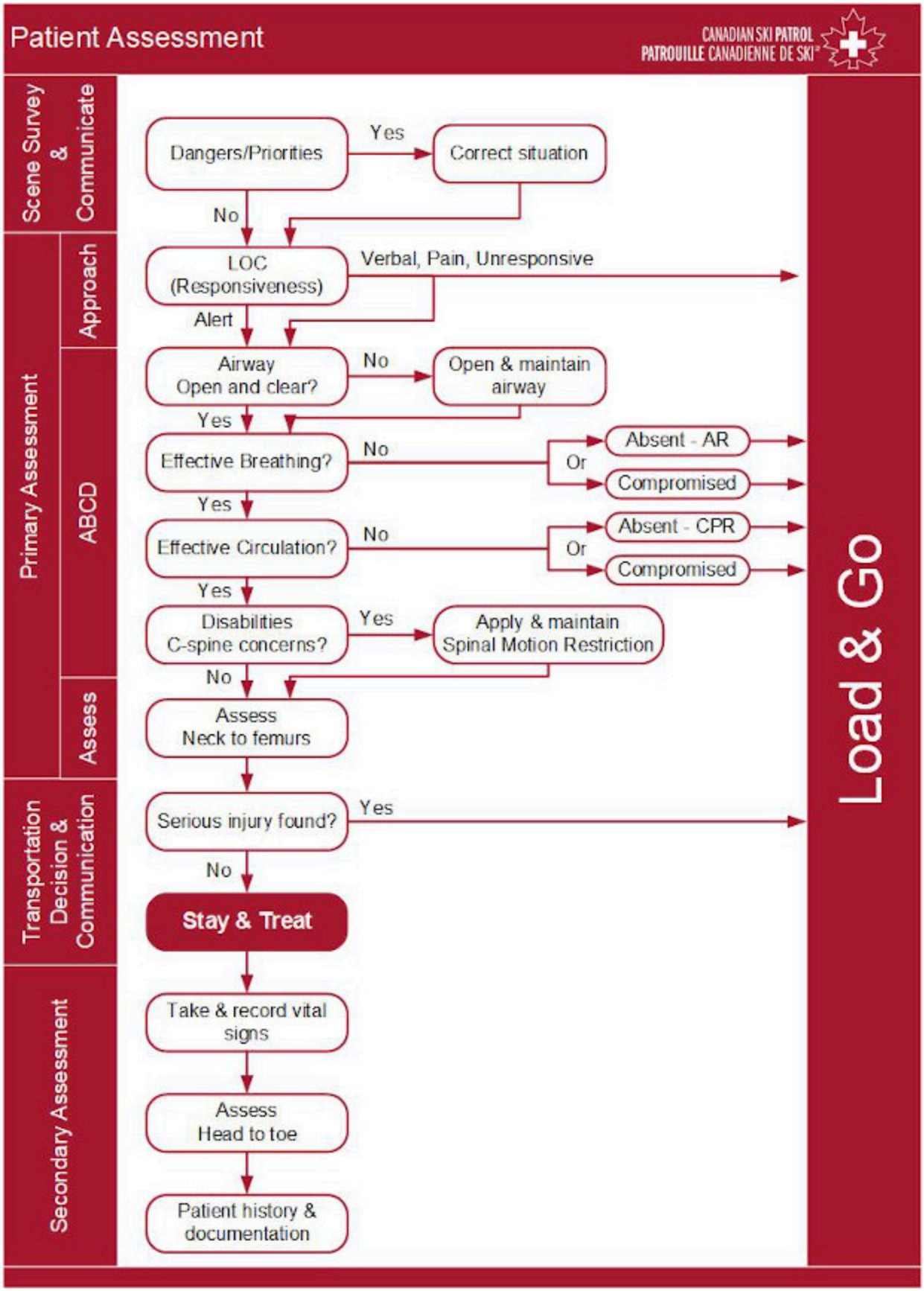
Patient Assessment
CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI
Scene Survey & Communicate
Primary Assessment
Approach
ABCD
Assess
Transportation Decision & Communication
Secondary Assessment
Load & Go
Dangers/Priorities
Yes
Correct situation
No
LOC (Responsiveness)
Verbal, Pain, Unresponsive
Alert
Airway Open and clear?
No
Open & maintain airway
Yes
Effective Breathing?
No
Or
Absent - AR
Compromised
Yes
Effective Circulation?
No
Or
Absent - CPR
Compromised
Yes
Disabilities C-spine concerns?
Yes
Apply & maintain Spinal Motion Restriction
No
Assess Neck to femurs
Serious injury found?
Yes
No
Stay & Treat
Take & record vital signs
Assess Head to toe
Patient history & documentation

Patient assessment

The patient assessment process is your tool to:

- Ensure the safety of yourself and others.
- Get help when you need it.
- Evaluate rationally and accurately the severity of a person's injuries.
- Make prudent and timely decisions about treatment and transportation.

Every situation is different but it is the same process every time. This will allow you to avoid hazards to yourself, the patient, and others who may be around. It will also allow you to get an initial sense of what has happened and how to manage the situation. Use your patient assessment checklist as a guide through this section.

Stages in assessment

Scene survey and communication	Is it safe and do you need help?
Primary assessment	Are there life-threatening injuries?
Transportation decision and communication *	Is it a Load and Go, or stay and treat?
Secondary assessment	Establish baseline vital signs and thoroughly reassess patient for all injuries.

* Note: communication related to a 'Load and Go' situation takes place at the time it is assessed

Barriers to effective communication

The patient assessment assumes effective communication with the patient, however, patrollers may encounter barriers to effective communication that may necessitate adaptation of the assessment. Possible communication barriers and potential mitigation may include:

- The patient is not alert (see Level of consciousness (LOC) in Chapter 4) – question bystanders about what happened, but otherwise continue to assess and talk to the patient as if they are alert and able to see you.
- The patient is alert but confused and unable to answer questions – question bystanders about what happened, but otherwise continue to assess and talk to the patient as if they are alert and fully oriented.
- The patient is alert but does not speak or understand the patroller's language – seek the help of a translator, if available, and use visual cues on yourself or a bystander to explain what you are doing.
- The patient is a child - see Chapter 20: Communication with a child.
- The patient is blind, deaf or mute – see Chapter 22: Visual and auditory deficits, question caregivers or bystanders about what happened if effective communication is impacted.
- The patient has an intellectual disability – see Chapter 22: Intellectual disabilities, question caregivers or bystanders about what happened.

If possible, during the patient assessment maintain face-to-face contact with the patient and monitor their face for visual clues of injury, such as wincing or grimacing in response to a pain stimulus.

Scene survey and communication

As you approach the scene of an incident, do the following:

1. Scene safety: Are there any dangers to myself, the patient or others?
2. Communicate to other patrollers that you are on scene, noting the time of arrival and location.
3. Consider the PPE required. Donn PPE before approach to patient.
4. Look for the mechanism of injury.
5. Look for the number of people injured. If more than one, conduct triage.
6. Look for severe bleeding.
7. Look for angulated fractures.
8. Look for the patient's physical and emotional response.
9. Look for the patient's skin condition (colour, moisture).
10. Communicate incident status. Request assistance if required. Communicate a Load and Go transport decision at any time a life-threatening situation has been assessed. Ensure you maintain regular communication with other patrollers regarding the status of the incident response.

Primary assessment

The primary assessment is a rapid, systematic check for life-threatening conditions that begins as you get closer to the patient. It includes a thorough assessment of the core areas of the body (priorities).

Take action to manage priority problems as they are found. If life-threatening conditions are found, quickly attempt to manage those threats.

Take care of ABCDs:

A	Airway
B	Breathing
C	Circulation
D	Disabilities (neurological deficits)

Primary assessment: Approach

11. Approach the patient face to face.
    - Attempt to reduce the need for the patient to turn to see or listen to you. If possible, during the patient assessment maintain face to face contact with the patient and monitor their face for visual clues for understanding and injury, such as wincing or grimacing in response to a pain stimulus.
    - The primary assessment of the patient is conducted in the position found.

- In a declared epidemic or pandemic environment, follow public health guidelines and maintain physical distancing until consent to treat has been obtained and standard precautions have been taken.

12. Check for responsiveness and obtain consent. Say, "Hello, my name is ____. I am a Canadian Ski Patroller trained in first aid. May I help you?" At this stage there may be different patient responses that may include:
    - The patient may say “No”. In this case, stand by at a safe distance until you determine that the person can safely leave the incident site or requests assistance.
    - The patient says “Yes”. In this case, the patient is alert, has at least a partially open airway, is breathing and has circulation. The quality of each will be checked later.
    - The patient is alert but cannot answer due to choking – relieve the choking! (see Choking in Chapter 6)
    - There may be no cognitive response from the patient. In this case, consent is implied. (see Implied consent in Chapter 1)
13. Caution the patient not to move. Say, "Please do not move until I have checked you for injuries."
14. Ask: “What is your name?”
15. In a declared epidemic or pandemic environment, follow public health guidelines. These may require additional PPE to be worn, asking additional screening questions of the patient and offering PPE, such as a mask, to the patient.
16. Ask: “What happened? How long ago did it happen?”
    - This provides information related to mechanism if injury and time progression of signs and symptoms.
17. Ask: "Do you hurt anywhere? Have you had this before?"
    - This provides information on chief complaint and patient history.
18. Acknowledge the patient’s chief complaint and quickly check the site for life-threatening signs/symptoms.
    - This reflects your interest in the patient’s concern and respect for their feelings as well as guiding the initial assessment.
19. Assess and rate the LOC by assessing each of the following. If the assessment is V, P or U this is a potentially life-threatening situation. A transport decision of ‘Load and Go’ and appropriate communication would follow.

Level of consciousness (LOC) (or responsiveness)

If a non-alert patient regains consciousness at any time during the patient assessment, re-introduce yourself and confirm consent to treat them and begin the assessment again to ensure you have feedback from your patient.

Record your results along with the time and type of stimulus used.

Level of consiousness

A	Alert	A patient who is alert is able to answer all or some questions about their name, where they are, what time of day or day of the week it is and what has happened in the past several minutes. A confused patient or a patient with memory loss due to a concussion is still alert on the AVPU scale.
V	Verbal	A patient who is not alert, but responds in some way to a loud voice is said to be responsive to verbal stimulus. The patient will not react spontaneously, but only responds to your stimulus. This is called "responds to verbal stimulus," even though the patient may not produce intelligible words, or the words may not make sense.
P	Pain	If there is no response to verbal stimuli, administer a painful stimulus. The stimulus must create a pain sensation without being damaging. You may: • firmly pinch the trapezius muscle between the shoulder and the neck • squeeze an object like a pencil at the base of a fingernail Apply only the minimal stimulation necessary to obtain a response. The normal reaction to pain is to withdraw from it or to attempt to push it away. Anything else is an abnormal reaction. Abnormal reactions in response to the painful stimulus include: • not responding at all • either flexing or extending the arms in addition to trying to point the toes and arch the back
U	Unresponsive	If the patient shows no reaction to either verbal or pain stimuli, they are said to be unresponsive.

Glasgow Coma Scale (GCS) – For information only

The Glasgow Coma Scale (GCS) is another protocol used to determine level of consciousness (LOC). It is referred to in the Spinal Motion Restriction Protocol and may be referred to by paramedics when transferring patients to the next level of care. A CSP regular member is not evaluated on this procedure.

The GCS is a neurological scale used to objectively describe the conscious state of a person. It also allows for easy trend identification when taken over time. The scale is based upon the evaluation of eye opening, verbal response and motor response.

Eye opening is scored on a scale from one to four, verbal response on a scale from one to five and motor response on a scale from one to six. The best response in each category is used to calculate the overall score. The minimum score is three, the maximum is 15.

Score	Eyes	Verbal	Motor
1	Does not open eyes	Makes no sounds	Makes no movements
2	Opens eyes in response to painful stimuli	Incomprehensible sounds	Extension to painful stimuli
3	Opens eyes in response to voice	Utters inappropriate words	Abnormal flexion to painful stimuli
4	Opens eyes spontaneously	Confused, disoriented	Flexion or withdrawal to painful stimuli
5	N/A	Oriented, converses normally	Localizes painful stimuli
6	N/A	N/A	Obeys commands

Primary assessment: ABCDs

This assessment includes an initial check of airway, breathing, circulation, and disabilities. If the patient is responsive (A, V, P), ABCs are obviously present but their quality has yet to be assessed. If there are obvious problems with ABCs including severe bleeding, address those problems immediately and communicate and transport as a Load and Go.

20. Airway

20. Check for and establish a clear airway. Listen to the patient's airway sounds. If the person is speaking to you, the patient's airway is not obstructed.

- A quiet airway is open.
- A noisy airway may be partially obstructed: reposition the head, taking spinal precautions if necessary.
- A silent airway is closed: open it! (see Managing the airway in Chapter 6)

21. Breathing

Look, listen, and feel for presence of breathing for no more than 10 seconds. Observe depth (deep/shallow) and effort (normal/laboured).

To avoid exposure to the patient’s exhaled breaths, the patroller should rest their hand on the patient’s upper abdomen to feel for respirations. This can be done in conjunction with a radial pulse check.

Check the rise and fall of the chest visually. If the patient is speaking, there is some air movement into and out of the chest. If the patient speaks only one or two words between breaths, this is a sign that they have breathing difficulty.

- If breathing is absent, administer artificial respirations (see Artificial Respirations (Rescue breathing) in Chapter 6). Activate EMS.
- If breathing is inadequate (too slow or too fast), call for oxygen and be prepared to assist using artificial respirations.
- If breathing is inadequate and there is evidence of an opioid overdose, administer naloxone if it is available and you are trained in its administration (see Antidotes in Chapter 17).

Ask “Can you take a deep breath? How did that feel?”

- The ability to take a deep breath is a very good sign that a chest injury is unlikely, but is not a replacement for the assessment of the chest.

23. Circulation

Look at the patient’s skin colour.

Assess the radial pulse for presence. If pulse is not present assess the other wrist or the carotid artery (neck). Assess pulse for presence, strength and rhythm for no more than 10 seconds.

If pulse is absent, start CPR (see Cardiopulmonary resuscitation in Chapter 6). Activate EMS.

Control any severe bleeding that is found using an appropriate pressure bandage or tourniquet (see Chapter 13). Control severe bleeding before starting CPR.

24. Consider the need for oxygen

Assess the need for oxygen if breathing or circulation seems abnormal (e.g., signs of shock), or if there is an altered level of consciousness (see Hypoxia in Chapter 5). The requirement for oxygen equipment must be included in communicating the transport decision.

25. Disabilities (neurological deficits)

Ask:

- "Do you have any pain or tingling in your neck or back?"
- "Can you wiggle your fingers and toes?”
- “Do you have any tingling or numbness in your fingers and toes?"

Nerves within the cervical spine control the head, breathing, and the upper extremities. Pain, numbness, weakness, and tingling are symptoms that may develop when one or more spinal nerves are injured, irritated, or stretched. If there is no pain or tingling and they can wiggle their fingers and toes then preliminary indications are the functions along the entire vertebral column are intact.

Assess the neck and cervical vertebrae and assess the need to apply and maintain spinal motion restriction (SMR) (See Spinal Motion Restriction (SMR) Protocol in Chapter 11).

Assess and palpate the neck with particular attention to the cervical vertebrae.

- Are the muscles rigid?
- Does the exam cause the patient further discomfort or anxiety?
- Does touching cause numbness or a tingling sensation?

If the answer is yes to any of these, treat for a C-spine injury.

A cervical spinal injury is unlikely if all of the following are met:

- During the scene survey, you saw the patient freely moving their head without apparent pain.
- Patient has had no loss of consciousness.
- Patient is fully alert (person, place and time).
- Patient has not had any alcohol or other drugs.
- Patient has no tenderness or deformity of the spine.
- Patient has no other painful injuries which may mask neck or back pain.
- Patient has no loss of sensation or movement in the limbs.

Primary assessment (neck to femur)

The next part of the primary assessment is a visual and physical assessment of the body core (neck to femurs). This is a rapid assessment of the core areas of the body for life-threatening injuries or medical conditions.

Signs and symptoms

A sign is something you observe. A symptom is something the patient tells you.

Throughout each step of the assessment, check for signs and symptoms of injury and medical or environmental conditions. Whenever you palpate or assess a part of the patient’s body, ask them “How does that feel?” This provides effective added feedback regarding signs and symptoms.

Look for DCAP-BLS:

D	Deformities - malformation, distortion, or disfigurement
C	Contusions - bruise or tissue injury usually without a break in the skin
A	Abrasions - scraping or rubbing of the skin and possibly tissues immediately below the surface
P	Penetrations - piercing or penetration of the skin
B	Burns - heat or chemical injury
L	Lacerations - cut, split or break in the skin
S	Swelling - abnormal enlargement

Feel for TIC:

T	Tenderness - pain or sensitivity
I	Instability - lack of stability or firmness
C	Crepitus - a grating sensation felt over fracture sites

After examining each part of the body, check your gloves for blood or wetness.

Listen

Listen to what the patient has to say such as:

- “That hurts.”
- “I have a pain in my chest."
- “I'm dizzy.”
- “I feel nauseous.”
- “I can't move that.”

Areas of evaluation in the primary assessment

Start a systematic check of the patient from the neck to the femurs. Examine the patient in the position found; remember, you asked them not to move. If the patient is in such a position that they cannot be effectively evaluated for life-threatening conditions, check as much of the patient as possible before you move them according to C-spine concerns.

When assessing the patient, you may identify signs and symptoms that require closer assessment. This may involve exposing the body part for a closer visual and physical assessment. Weather conditions should always be considered when exposing the skin for any length of time.

28. Assess the neck

Assess the full neck including the cervical vertebrae.

Look for evidence of DCAP-BLS.

Feel (palpate) the neck for evidence of TIC. Notice if touching the back of the neck causes the patient discomfort or anxiety. Ask the patient if touching their neck causes any numbness or tingling sensations. If you cannot feel the vertebrae, is it because the muscles are rigid?

If any of these signs or symptoms are positive, suspect a spinal injury and employ SMR.

Check your gloves for blood or wetness.

29. Assess the back

Look for evidence of DCAP-BLS.

Feel (palpate) along the spinal column for evidence of TIC.

During the rapid, systematic primary assessment, the focus on the palpation of the back is the spinal column from cervical vertebrae to coccyx and alongside the vertebrae. A more thorough assessment will be expected during the Secondary assessment.

If the patient is lying face up (supine), evaluate the back when the patient is rolled to get them onto a backboard or similar lifting/stabilization device.

Check your gloves for blood or wetness.

30. Assess the chest

Look for evidence of DCAP-BLS. At the chest also look for paradoxical movement - ribs or segment of ribs moving differently. This adds an additional P to DCAP for the chest (DCAPP). Where the chest normally expands during inspiration, a loosened segment will be drawn in. Where the chest normally deflates during expiration, the loosened segment will bulge.

Feel (palpate) the chest for evidence of TIC. At the chest, also feel for subcutaneous emphysema, air bubbles under the skin -- which feel like puffed rice cereal or bubble wrap popping. This adds an additional S to TIC for the chest (TICS).

Place open hands on both sides of the chest wall and squeeze once to slightly flex the ribs. Asking the patient "how that feels?” will provide effective feedback. An earlier indicator of chest injury may have been found when asking the patient to take a deep breath when you were checking ABCDs.

Check your gloves for blood or wetness.

31. Assess the abdomen

Look for evidence of DCAP-BLS.

Feel (palpate) the abdomen for tenderness (T), rigidity (R), guarding (G), distension (D) and evisceration (E). Instability and crepitus relate to bones and are not relevant for the abdomen.

Palpate the abdomen using a flat hand, pressing firmly but gently (about one cm depth to elicit a response) on each of the four quadrants of the abdomen.

The most common cause of abdominal distension is the accumulation of intestinal gases, due to the slowed intestinal passage as a result of injury to the abdomen, blocked or twisted bowel or lack of blood supply (ischemia) due to trauma or shock. Distension can also occur when blood begins to pool in the abdominal cavity, as a result of rupture of an abdominal organ, or due to a very full bladder.

Evisceration is caused by a laceration or puncture wound to the abdomen which results in the protrusion of intestines through the opening.

Check your gloves for blood or wetness.

T	Tenderness is pain or sensitivity
R	Rigidity is a late sign of internal bleeding.
G	Guarding is localized involuntary muscle contraction when the injured area is touched.
D	Distension is bulging or swelling.
E	Evisceration is the protrusion of intestines through an abdominal wound.

32. Assess the pelvis

Look for evidence of DCAP-BLS.

Feel (palpate) the pelvis for instability or pain by gently squeezing the iliac crests of the pelvis together above the widest part of the hips (TIC).

The pelvis is an extremely strong, rigid structure. It takes a great deal of energy to do damage. Therefore, if the pelvis is fractured, it is a serious injury. The vessels in and around the pelvis are large. Blood loss can be significant if these vessels are damaged. Pelvic injury can also result in the rupturing of the bladder.

Check your gloves for blood and wetness.

33. Assess the femurs

Look for evidence of DCAP-BLS. Even scarcely detectable swelling, associated with a fracture of the femur, may easily contain two litres of blood. If the femur is fractured, the foot will turn out or roll laterally when the patient is supine. The foot may also turn-in or roll medially if there is a femoral dislocation.

Feel (palpate) for evidence of TIC.

Assess the femurs by using a two-handed technique to firmly squeeze along each femur to the knees.

Femur fractures are high-energy injuries. If a femur is fractured, it is a potentially life-threatening injury due to significant blood loss and to the high likelihood that the patient will develop shock. They may also have other internal injuries.

Check your gloves for blood or wetness.

Transportation decision and communication

34. Transportation decision

A transportation decision is based on the assessment of the seriousness of the injuries or medical condition related to the patient. If it is determined the situation is life threatening at any time during the Patient Assessment, a Load and Go is made and immediately communicated to colleagues or base. If the assessment does not identify a life threatening situation, the transportation decision will be to Stay and Treat and will be communicated following the Primary Assessment. It is important to communicate your decision at this stage, however a decision may

be upgraded to Load and Go and communicated at any time dependent on the status of the patient.

It is important to maintain regular communication to update colleagues or base on the incident status. This includes: arrival at the scene; transportation decision with any assistance and equipment required; departure of the incident scene with patient; and incident site cleared.

Load and Go

Load and Go is an attitude as well as a transportation decision. It involves recognizing the importance and urgency to get the patient to advanced medical care. The reality is that in spite of making this decision, you may still be on scene for an indeterminate amount of time due to problems with evacuation, transport, or weather amongst many other things. The critical point is that you have recognized the patient needs to go as soon as possible.

If the patient has a life or limb threatening condition, you must:

- Continue life support.
- Stabilize any major injuries as quickly as possible.
- Apply oxygen, as required and if available.
- Load the patient into a toboggan (preferably on a backboard) or other means of transport.
- Transport to EMS.

Life-threatening conditions

- Compromised ABCs
    - Airway control problems
    - Any breathing problem that cannot be corrected quickly
    - Chest injuries that affect breathing
    - Circulatory problems including uncontrollable bleeding, shock, cardiac chest pain
    - Impaired distal circulation in extremity injuries
- Neurological disabilities
- Reduced LOC
    - unresponsive
    - responsive only to verbal or pain stimulus
    - head injury with unconsciousness
- Internal injury or bleeding
- Acute abdominal pain
- Tender, guarded, rigid or distended abdomen
- Unstable pelvis
- Fractured femur

While waiting for transport, prepare your patient for rapid transportation. Once you have begun this evacuation, you do not have time to complete the secondary assessment, apply extensive splinting or treat minor injuries. A backboard, scoop stretcher or vacuum mattress allows you to stabilize all long bone fractures against the patient's body and move the patient more easily to transport with less risk.

If the means of transportation still has not arrived, you may have the opportunity to complete a secondary assessment. If the secondary assessment is completed prior to the arrival of transportation, a second set of vital signs can be taken to determine if there was any change from the first baseline measurement. Additional treatment may be administered if required.

A Load and Go decision may also be made due to environmental conditions (cold, storm, wind, etc.) that may impact on the safe extraction and transport of the patient.

Stay and treat

The point of the transportation decision is about when, not if, to move the patient. Without life-threatening issues where time is of the essence, the patroller can stay and treat the patient when transportation arrives, then leave for more hospitable surroundings or further medical attention. Treatment on the scene will provide greater patient comfort immediately and during transport to the next level of care.

Communication

35. Communication

Communicate the condition of the patient and request appropriate assistance and equipment. Whatever you describe, be concise and accurate. Provide a summary of the abnormal findings of your primary assessment.

Techniques vary. Most ski areas provide radios. Often there are special radio codes for serious injuries. Know the codes for your area. If your area allows you to describe the severity of injury over the radio, be concise and accurate. Follow the same format for information delivery as you used for your primary assessment.

Example

Base hut, this is Wilson at the bottom of Run 5. I am on the scene of a collision between a skier and a tree. The patient is:

- a young adult male
- unresponsive
- rapid, shallow laboured breathing
- Carotid pulse present, radial pulse absent
- Flail chest on the left side
- I need a backboard, oxygen, toboggan and additional assistance right away. Activate EMS.

Secondary assessment

Having completed the primary Assessment for life threatening injuries or conditions, you have made and communicated your transportation decision. Now, if waiting for transportation, and having addressed the life threatening situation to the best of your ability, you, or a fellow patroller if available, have the opportunity to do a further full body, head to toe, assessment ensuring that you have not missed any secondary injuries or conditions, and to monitor the status of your patient to determine if there are any changes in their condition since your arrival. A key example of the benefits of both assessments is the ability to uncover a progressive deterioration of the patient's condition, such as the development of shock due to internal bleeding or a sudden loss of consciousness.

It is possible that, even if you have made a decision that this is a "Stay and Treat" following your Primary Assessment, that you may identify a change or other injuries/conditions during the Secondary Assessment that is life-threatening and necessitates changing your decision to a "Load and Go". You would communicate this immediately.

The Primary Assessment is a rapid, systematic assessment to determine if there are any life threatening injuries/conditions. The Secondary Assessment is also systematic but does include the entire body and allows for a more thorough assessment to both confirm findings in the Primary Assessment, identify secondary or hidden injuries/conditions, and to observe any change in status.

During the Secondary Assessment you will also ensure that you have all relevant information required by the next level of care to appropriately treat your patient.

The secondary assessment consists of four major parts:

1. vital signs
2. head-to-toe exam
3. patient history
4. documentation (see sample intervention report in AFA documents at end of the manual)

With practice you will be able to ask questions related to patient history (and remember the answers) at the same time you are performing your primary or secondary assessment of the patient. If there is an altered level of consciousness, or risk of a person losing consciousness, it is important to gather critical information such as name, contacts, medical conditions, medications, allergies, etc. as quickly as possible.

Secondary assessment: Vital signs

36. Measure and record:

- time vital signs were measured
- airway and breathing rate (rate, depth, effort)
- circulation (rate, strength, rhythm)
- blood pressure (estimated by pulse or by cuff and stethoscope)
- level of consciousness (on AVPU scale)
- pupil reaction to light (size, equality and reaction) (PERL – pupils equal and reactive to light)
- skin condition (colour, temperature, moisture)
- pain description using the acronym OPQRST.

Vital signs are most meaningful when compared over time. The first set is the base line to which a patient's improvement or deterioration is measured. Always record the time and findings with each set of vital signs you take.

With the first set of vital signs, also record:

- time the incident occurred and/or the time you first arrived on scene
- your findings in the primary assessment
- the patient's full name
- a name and phone number for a contact person

This is important if the patient later becomes unresponsive. Record the history details later. The intervention report found in this manual can be used as a resource for recording information. It is helpful to refer to the sample intervention report as you review this section. The intervention report is part of your first aid supplies and may be used as a checklist to ensure all necessary information is captured to share with the next level of care.

For severely injured patients, when shock is suspected, or ABCs are compromised, measure vital signs every five minutes for the first 15 minutes, then every 15 minutes for the next hour.

When assessing vital signs the patroller should consider aerosolization risks.

Breathing

Observe rate, depth and effort needed to breathe. Note airway sounds while you check the breathing as per the primary assessment. To avoid exposure to the patient's exhaled breaths, the patroller should rest their hand on the patient's diaphragm or back to feel for respirations.

Count the number of regular breaths/chest expansions in 15 seconds, then multiply by four. For example: four breaths in 15 seconds are recorded as 16 breaths per minute.

Normal resting respiratory rates for various ages

Age	Respiratory rate (breaths per minute)
Infant (up to one year)	30 to 50
Toddler (one to four years)	20 to 30
Child (five to 12 years)	12 to 20
Adult	12 to 20

Causes of altered breathing rate

Respiratory rate	Possible causes
None	Respiratory arrest
Slow (< 10/min)	Stroke Head injury Overdose Chest injury
Fast (>20/min)	Asthma Shortness of breath Chest injury Shock
Patterned	Head injury Hyperglycemia

Pulse

Observe the heart rate, strength, and rhythm. The most frequent site for taking a pulse is the inside of the wrist using the radial artery. The most dependable site to take a pulse is either side of the larynx. The carotid artery can easily be felt here because it is very large and close to the

Normal resting pulse rate

Age	**Pulse rate (beats per minute)**
Infant (up to one year)	80 to 160
Toddler (one to four years)	80 to 120
Child (five to 12 years)	60 to 110
Adult	60 to 100

heart. Although the carotid gives better results, patients usually find it intimidating and it does not give an indication of perfusion in the extremities.

Count the number of beats in 15 seconds, then multiply by four (double and double again). For example: 19 beats in 15 seconds are recorded as 76 beats per minute.

Note the strength of the pulse as bounding (very strong), strong (full) or weak. Note the rhythm as regular or irregular.

Causes of altered pulse characteristics

Pulse rate	Possible causes
None	Cardiac arrest
Slow (< 60/min)	Cold injury Heart attack Overdose
Fast (>100/min)	Shock Heart attack Heat injury
Pulse strength	**Possible causes**
Weak	Shock Heart attack Cold injury Overdose
Strong	Normal
Bounding (very strong)	Heat injury Overdose Heart attack
Pulse rhythm	**Possible causes**
Irregular	Heart attack Overdose
Regular	Normal

Blood pressure

Blood pressure is the pressure that circulating blood exerts against the walls of the arteries. Blood pressure readings, measured in mmHg, are recorded by placing the systolic pressure over the diastolic pressure (e.g. 120/80). Systolic pressure is the level of pressure during the contraction of the heart, when blood is being pumped through the arteries. Diastolic pressure is the pressure in the vessels during relaxation of the heart, when blood is returning to the heart.

Blood pressure levels vary with age, sex and ethnicity.

Blood pressure can be estimated using the following averages:

- If a radial pulse is present, the systolic pressure is considered to be above 80 mmHg.
- If only the carotid pulse is present, then the systolic pressure is above 60 mmHg.

If available and the patroller is trained, blood pressure is measured by a device called the sphygmomanometer, also called a blood pressure cuff, which is used in conjunction with a stethoscope.

To measure blood pressure, secure the cuff around either arm of the patient just above the elbow. Follow the directions on the cuff for proper placement of the pressure diaphragm over the brachial artery. Find the brachial artery by palpating the arm in front of the elbow.

Inflate the cuff with the rubber bulb until the pressure is about 20 points above the point where the needle of the dial stops moving with the pulse. Avoid over-inflating the cuff, since this can be painful for the patient.

Place the stethoscope diaphragm over the brachial artery in front of the elbow. Using the release valve located at the bulb, slowly release the air from the cuff. The point on the dial at which the first sound of a pulse is heard through the stethoscope, is the systolic pressure.

While listening through the stethoscope, slowly continue releasing the air from the cuff. The point on the dial at which the pulse sound disappears, is the diastolic pressure.

Level of consciousness

Record the patient's LOC on the AVPU scale as described in the primary assessment.

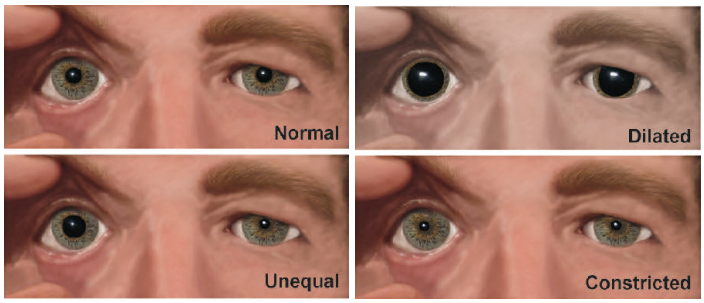

Figure 4-1: Pupil response

Pupil reaction

Normally, pupils dilate (enlarge) in dimmer light and constrict (become smaller) in brighter light. Note that up to 10 per cent of normal individuals have unequal pupils. The pupils of the eyes are good indicators of the condition of the circulatory system and the brain. Normal eyes react to light equally and quickly. Examine for PERL:

Perform the evaluation with a penlight, if available, or by having the patient close their eyes for a count of 10 and then open. The pupils will have dilated sufficiently to be able to observe their response to increased light. Do not shine a penlight directly into the pupil. This is uncomfortable; shine the light from the side of the eye.

P	Pupils
E	Equal and
R	Reactive to
L	Light

Pupil evaluation	
Pupil reaction and size	**Suspect**
Equal and reactive	Normal
Non-reactive	Glass eye or contact lens
Fixed and dilated	Severe damage to the central functions of the brain Brain hypoxia
Impaired or unequal reaction to light	Intracranial pressure head injury Stroke Congenital
One pupil dilated and one pupil normal	Damage is limited to one side of the brain
Fixed, constricted pupils	Drug use or severe irreparable brain damage
Small, pinpoint	Drug usage or disease
Constricted pupils that later become fixed and dilated	Worsening condition

Skin condition

The condition of the skin is a good indicator of the circulation and oxygenation status of the patient.

Assess the for skin for:

C	Colour - by looking at the patient's face, nail beds or inside the mouth
M	Moisture - both visually and by touch
T	Temperature - by placing the back of your hand on the patient's forehead

Compare what you would expect the skin to be like given the patient's activity immediately prior to the incident, to what the skin is actually like. For instance, some activities may have caused the skin to differ from the usual pink, warm and dry. In the absence of strenuous activity, on a cold day the skin may be cool or even cold. After strenuous activity, such as during a race, it could be flushed, hot and sweaty.

Skin condition

Symptom	Possible causes
Blue (cyanosis)	Lack of oxygen
Pale, cool and clammy	Circulatory problems (shock, internal bleeding), heat exhaustion, hypoglycemia (insulin shock)
Dry, warm, flushed	Hyperglycemia (diabetic coma)
Cold waxy	Hypothermia, severe frostbite
Red	Frostbite, burn
Yellow	Hepatitis/liver dysfunction
Flushed	Heat stroke, crushing chest injury

Pain measurement

The perception of pain is a symptom. A patroller can see the patient is experiencing discomfort, but is unable to measure it directly.

Pain level

		Questions to ask:
O	Onset	How did the pain start? Was it sudden, gradual, or an ongoing chronic problem?
P	Provoke	What provokes the pain or causes it to get worse? E.g. movement or pressure. Is it better with rest?
Q	Quality	How would you describe the pain? (Burning, shooting pain, numbness, throbbing, etc.)
R	Radiation	Where, exactly, is the pain located? Does it radiate to other areas?
S	Severity	How bad is the pain? 10 is the worst pain imaginable.
T	Time	When did the pain begin? How long has it been present? Is it intermittent or constant?

Young children may find it easier to describe their pain by relative size instead of numeric magnitude, e.g. floor is no pain, ceiling is the most pain, how tall is your pain?

Secondary assessment: Head-to-toe exam

Check the core areas again using the same techniques as the primary assessment (neck to femurs). Expose as necessary.

45. Assess the head

Look for evidence of DCAP-BLS.

Check for signs which may indicate a skull fracture:

- blood and/or fluid in the ears or nose
- bruising behind the ears (Battle's sign)
- bruising around the eyes (sometimes called "raccoon eyes")

Check the mouth for broken teeth, blood and/or a fractured lower jaw.

Feel (palpate) the head for evidence of TIC. Feel the face for fractures, particularly just under the eyes, the nose and the upper jaw.

Check your gloves for blood or wetness.

Listen to what the patient tells you. Have the patient clench their teeth to check for pain in the jaw possibly indicating a fracture.

46. Assess the neck

Proceed as for a primary assessment

47. Assess each clavicle

Look for evidence of DCAP-BLS.

Feel (palpate) the clavicles for evidence of TIC. Gently push against the clavicle as you trace the path from the centre of the chest to the shoulder, one at a time.

Check your gloves for blood or wetness.

Listen to what the patient tells you. A fractured clavicle is a painful injury.

49. Assess each scapula

Look for evidence of DCAP BLS

Feel (palpate) each scapula for evidence of TIC. Using the flat of your hand push on each scapula (shoulder blades) one at a time. A broken scapula is caused by heavy forces that might also have injured the chest, lungs, or internal organs.

Check your gloves for blood or wetness.

51. Assess the back

During the primary assessment the attention was focussed on the spinal column and either side from the cervical vertebrae to the coccyx. In the secondary assessment a more thorough assessment of the back takes place with a flat hand palpation of the spinal column and muscle areas of the back below the scapula, including areas over the kidneys to the gluteus muscles.

Check your gloves for blood or wetness.

52. Assess the chest

Proceed as for a primary assessment

53. Assess the abdomen

Proceed as for a primary assessment

54. Assess the pelvis

Proceed as for a primary assessment

55. Assess each femur

Proceed as for a primary assessment

56. Assess each of the lower legs (knee, calf, ankle, foot and toes proceeding from each femur)

Look for evidence of DCAP BLS.

Feel (palpate) for evidence of TIC. Use a two-handed technique to firmly squeeze all the way down the lower leg. If only one hand can be used, use the side of your thumb to press on the angular edge of the tibia all the way down its length. Use a similar technique to trace the fibula (outer side of the leg) down its length.

Check your gloves for blood or wetness.

Pulse, motor response and sensation (PMS)

P	Pulse indicates circulation at the extremities
M	Motor indicates whether a patient can move a finger or toe if asked to do so
S	Sensation indicates whether a patient can feel a touch or pain stimulus.

Check PMS of the lower extremities

Pulse

Apply a small amount of pressure to the toe or a spot of skin (above the boot) until the pressured area turns white and assess the capillary refill.

Capillary refill is the time it takes for the area to recover its normal colour. Normal refill time is less than two seconds in a healthy person. If capillary refill takes more than two or three seconds, it may be an early sign of shock or dehydration. Note that refill is delayed in cold environments.

Motor response

Ask the patient to move their foot or press against your hand. If the patient is wearing a hard boot, ask the patient to wiggle their toes while you feel the muscles at the front of their leg. You will feel the muscles tensing and relaxing.

Sensation

Test for sensation by gently pinching the skin on top of the foot or touch the skin just above the boot and asking the patient, "What did I do?" Try not to let the patient see what you are doing.

59. Assess each arm (shoulder, upper arm, elbow, lower arm, wrist, hand, fingers)

Look for evidence of DCAP BLS

Feel for evidence of TIC. Use a two-handed technique to firmly squeeze all the way down the arm to the fingers.

Check your gloves for blood and wetness.

Check the PMS of the upper extremities

Pulse

Apply a small amount of pressure to the fingernail bed or a spot of skin until the pressured area turns white and assess the capillary refill.

Motor response

Ask the patient to move all their fingers or squeeze your fingers.

Sensation

Test for sensation by gently pinching the skin on the back of the hand or touching one finger and asking the patient, "What did I do?" Try not to let the patient see what you are doing.

62. Patient history and documentation

As your assessment technique and experience increases, you will be able to ask questions of the patient at the same time you are conducting a physical assessment.

Depending on the situation, some of these questions may be pertinent during the primary assessment. You do not have to wait until the end of the secondary assessment to ask. If there is an altered level of consciousness, or risk of the patient losing consciousness, it is important to gather critical information such as name, contacts, medical conditions, medications, allergies, etc. as quickly as possible.

Now is the time to make sure previous information is recorded if not already done. Refer to the Intervention report sample.

Repeating these questions during the secondary assessment can be useful if you suspect a concussion or previous unconsciousness. See if the patient gives you the same answer late in the secondary assessment as early in the primary assessment.

- What is your name? Address?
- Who can be contacted for you?
- What happened?
- Do you have any medical conditions that I should know about?
- Are you on taking any medications and what are they for? Have they changed recently?
- Do you wear a MedicAlert?
- Do you have any allergies?
- Have you taken any alcohol or drugs today?
- Are you a bleeder? (Haemophiliac or taking blood thinners)
- Do you wear contact lenses or dentures?
- Have you had any serious illness, injury, or operations in the last year?
- When did you last eat?
- When did you last pass urine (in suspected pelvic/hip injuries)?

Figure 4-2: Medic alert/sample of engraving on back of bracelet/necklet emblem MedicAlert Foundation Canada

To help you remember the basic history information that needs to be gathered, use the acronym SAMPLE.

Patient history

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		Questions to ask:
S	Signs and symptoms	What's wrong? (Observe, ask and record)
A	Allergies	Do you have any allergies?
M	Medication	Are you taking any medication?
P	Past medical history	Do you have any medical conditions?
L	Last meal	When did you last eat or drink?
E	Events leading to the injury or illness	What happened to cause the problem?

Documentation is the best way to pass your information on to others in the health care system. Refer to the sample intervention report in the in the AFA Documents at the end of the manual. Local documentation procedures may apply. The report includes areas for recording information related to the incident that may be helpful to medical providers to whom the patient is referred.

Include the mechanism of injury and the position of the patient, as well as what you found during your assessment.

Include the best description you can and any treatments you administered. Your handwriting must be legible for your information to be useful.

You are the only member of the health care team to actually have witnessed the setting of the incident. This information is often crucial later in the treatment of the patient.

In addition to the intervention report or note to the doctor, it is important to understand that each area may have incident report forms to be completed. The patroller must be familiar with the various forms at their area and how to complete them.

Continue to refer to the Patient Assessment Checklist in the AFA documents at the end of the manual to review and study for your AFA skills record.

For information only

Upon receiving a call to an incident a patroller is trained and prepared to conduct a full patient assessment from scene survey to completion of the secondary assessment and transport to the next level of care. There are instances where a complete and thorough assessment with physical contact and thoroughness could be viewed as intrusive by a patient. An example of this is a very minor incident such as a patient arriving at the clinic with a wood sliver from a bench in their finger asking for assistance in removal. Upon contact the patroller will conduct their scene survey taking in information they observe about the individual and introducing themself and offering assistance. Upon asking assessment questions related to the patient assessment approach, the patroller may be able to ascertain there was no more to the mechanism of injury than the patient brushing their hand on the wooden bench and getting a sliver in their finger. While continuing to observe and question, the patroller may choose to focus on the removal of the sliver without conducting a full "hands on" primary assessment, taking a full set of vital signs and also conducting a full "hands on" secondary assessment.

However, if any observation or response to a question leads the patroller to believe there may be more involved than is presented, such as the patient having stumbled due to excess alcohol or drug intake, they would ensure they provide a complete systematic and thorough assessment which could result in transfer to further medical care for reasons well beyond the wood sliver in the patient's finger. At no time will a patroller ignore the protocol of conducting a patient assessment either "figuratively" or "hands" on. The elements of the complete patient assessment are considered in every incident.

Retake vital signs

For severely injured patients, when shock is suspected, or ABCs are compromised, take a set of vitals every five minutes for the first 15 minutes, then every 15 minutes for the next hour.

Pain management

Injuries are painful. To reduce pain, there are two pain management techniques that are approved for use by patrollers. These include pharmacological and non-pharmacological measures.

Non-pharmacological interventions

Injury stabilization by splinting and elevation, along with the application of cold packs, form the basis of non-pharmacological intervention.

By reducing local skin temperature, nerve conduction through pain receptors is slowed, reducing the perception of pain. In addition, swelling and inflammation is reduced which also reduces pain.

Make a cold pack by putting snow into a plastic bag.

Apply the cold pack for 10 to 15 minutes then take it off for 10 to 15 minutes and repeat indefinitely.

Manage the size of the cold pack so that only the injured area is cooled, rather than the entire limb. Place a cloth or thin layer of some material between the cold pack and the skin. It is important to monitor the skin to prevent frostbite, and to remove the cold pack if the patient complains of cold-induced pain.

Pharmacological interventions

Acetaminophen

Acetaminophen is an over-the-counter analgesic that is effective for sprains, strains and taking the edge off more painful injuries such as dislocations and fractures. Of the over-the-counter medications available, acetaminophen has the fewest side effects and can be taken by the greatest number of people.

The only precautions are people with a known allergy or sensitivity to acetaminophen, and children under the age of six. Even for people with acetaminophen sensitivity, the most common adverse reaction is the formation of a rash. Offering medications is subject to provincial, territorial or local regulations. If allowed, patrollers are authorized to respond to a request for pain relief by offering acetaminophen according to the following protocol:

1. Ask the patient about sensitivity or allergy to acetaminophen.
2. Obtain parental or guardian permission for children younger than 16 years old prior to offering acetaminophen.
3. Have the patient swallow the pill(s) with the minimum amount of water required to do so.
4. Continue to make transportation arrangements for the evacuation of the patient.
5. Document time, dosage of medication when given, response to treatment.

Acetaminophen is to be administered with the least amount of fluid required (sips of clear fluid), and patient is to refrain from having any other oral fluids if there is the possibility that further medical procedures or surgery will be required.

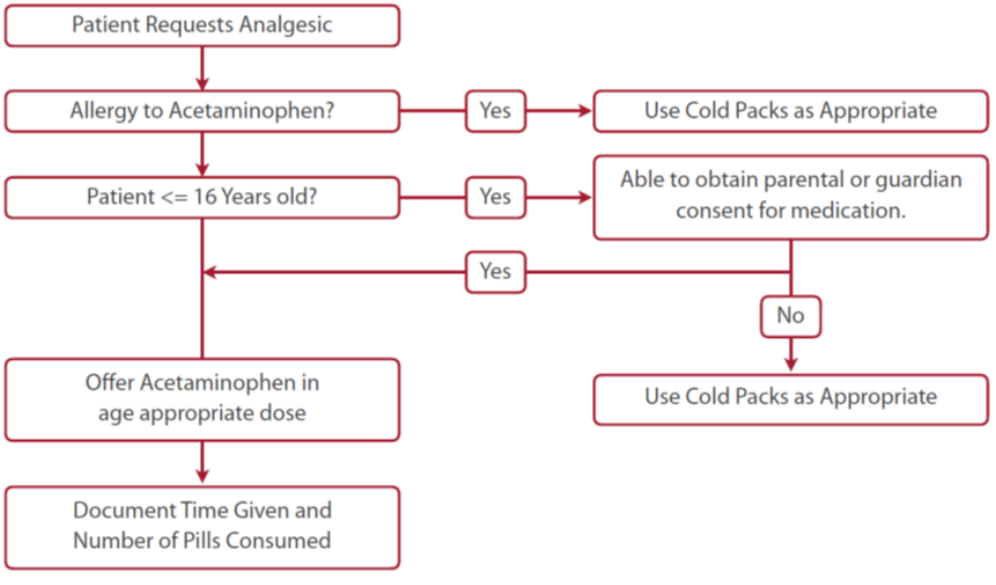
Acetaminophen - dose

CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI

Age	Maximum dose
6 to 12	325 mg
12 to 16	650 mg
16+	1000 mg

Acetaminophen administration protocol

CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI


Patient Requests Analgesic
Allergy to Acetaminophen?
Yes
Use Cold Packs as Appropriate
Patient <= 16 Years old?
Yes
Able to obtain parental or guardian consent for medication.
Yes
No
Offer Acetaminophen in age appropriate dose
Use Cold Packs as Appropriate
Document Time Given and Number of Pills Consumed

Multiple patients - Triage

Triage (French for "sort") is the process of sorting patients based on the seriousness of their injuries. Use triage if there are numerous patients involved to determine who may need help and who needs to be transported in what order. Patients are quickly assigned one of four colour codes as summarized in the following table:

Triage

Definition	Designation	Priority
Critical Life-threatening injuries. These patients have compromised breathing or circulation or LOC. They require immediate treatment and transportation.	Red	High
Serious Not immediately life-threatening. These patients have patent ABCs, no obvious signs of shock, and seem alert but are not likely walking. Any bleeds can be controlled. They require treatment but transport may be delayed.	Yellow	Medium
Minor May need treatment. These patients are walking and alert. Transport can be delayed with no detriment to the patient's outcome.	Green	Low
Dead or non-salvageable These patients have no spontaneous breathing even with a repositioned airway.	Black	None

START

This system of prioritizing patients is called Simple Triage And Rapid Treatment (START). The process is based on the process of rapidly assessing ABCD.

Assessing the patients is a continuous process. A patient's status can be upgraded or downgraded at any time as their condition improves or worsens. It is based on changes in the patient's condition, the availability of transportation, the arrival of additional manpower and the number of patients remaining. When additional patrollers arrive on the scene, you can quickly communicate the status of patients simply by reporting their triage colour.

General triage procedures

(Adapted from Community Emergency Response Team (CERT) conducting triage)

Step 1. Scene survey

- Note the time and location.
- Are there any further dangers to myself, the patients or any others?
- What is the mechanism of injury (what happened)?
- Is there more that one person injured? Yes
- Do I require assistance with handling the scene? Yes, call for help.

This scene survey focuses only on the physical scene and not the conditions of the patients.

Step 2. Conduct voice triage

Begin sorting patients by calling out, "Canadian Ski Patrol, if you can walk, come to the sound of my voice."

If there are injured or non-injured people who can walk, they are "green." They should be directed to a designated safe location while you continue with triage. If you need assistance, you can ask the "green" to help. They may also provide useful information about the locations of other patients.

Step 3. Follow a systematic route

Now you're ready to start working with non-ambulatory patients. To make sure that you don't miss anyone:

- start where you stand
- start with the closest patients
- work outward in a systematic fashion

Step 4. Triage and tag each patient red, yellow, green or black

Assess each patient for ABCDs. Check if they are breathing. If not, reposition their airway and check again. Any unconscious, breathing person should be put in the recovery position so they can keep breathing. Major bleeding should be controlled.

Assign each patient a tag/colour.

Step 5. Document triage results

After you triage patients in an area, record the number of patients by triage colour and their locations. This documentation will help responders and back up when they arrive to:

- identify the locations of patients
- deploy resources effectively
- estimate the number of patients by degree of severity

Triage pitfalls

- No team plan, organization, or goal.
- Indecisive leadership about where to start and what to do.
- Too much focus on one injury or person.
- Treatment rather than triage.

Change gloves every time you handle a new patient, your gloves must be clean, to avoid cross-contamination.

For information only - The Canadian Triage and Acuity Scale (CTAS)

The CTAS was designed to improve the process of triage in emergency departments.

CTAS is used to assign a level of acuity or severity to patients requiring aid and to define the patient's need for care. It is based on establishing a relationship between the patient's chief complaint, the potential causes and the patient's final diagnosis. These include how a patient looks, their vital signs and associated signs and symptoms. The patient is the focus of this triage system as it attempts to define the ideal time in which patients should be seen.

As most emergency medical services, or EMS, organizations are extensions of the emergency department this scale is routinely used by some EMS providers across the country. This ensures that paramedics, emergency staff, and, as front line providers of advanced first aid, the Canadian ski patroller, are speaking a common language for identifying a patient's condition.

CTAS is a five-level scale with the highest severity being Level 1-resuscitation and the lowest severity being Level 5-non-urgent.

Level 1 – resuscitation

> Conditions that are threats to life or limb (or imminent risk of deterioration) requiring immediate aggressive interventions.

Level 2 – emergent

> Conditions that are a potential threat to life limb or function, requiring rapid medical intervention or delegated acts.

Level 3 – urgent

> Conditions that could potentially progress to a serious problem requiring emergency intervention. May be associated with significant discomfort or may affect ability to function at work or activities of daily living.

Level 4 – less urgent

> Conditions that relate to patient age, distress, or potential for deterioration, would benefit from intervention or reassurance.

Level 5 – non urgent

> Conditions that may be acute but non-urgent as well as conditions which may be part of a chronic problem with or without evidence of deterioration.

Only members of the Canadian Ski Patrol, trained in CTAS by local or regional emergency medical services or paramedics may use this system. When EMS utilizes CTAS for pre-hospital patient care then usage by the CSP may be warranted.

Patient assessment during a declared epidemic or pandemic

If there is a declared epidemic or pandemic, the CSP will issue specific guidelines for patient assessment that are in accordance with local public health authority requirements.

These guidelines may modify the details of the patient assessment, however the general priorities of the primary assessment still apply. Depending on the disease, these details may include:

- a set of screening questions that need to be asked before a patient is assessed for injuries
- the routine use of additional PPE by the patroller, such as masks, face shields or eye protection, and isolation gowns
- providing PPE, such as a mask, to the patient or requiring them to use their own mask
- recording of patroller and patient names and contact details to facilitate contact tracing
- providing first aid supplies to patients who can self-manage and guiding them through the self-administration of wound dressings, ice packs, etc.

The CSP protocol is that the first patroller must do the screening as part of the patient assessment.

5. Oxygen

Learning outcome:

Describe, understand and demonstrate the use of oxygen in the treatment of a patient.

Upon completion of this chapter you should be able to:

1. Describe the oxygen delivery devices.
2. Describe the purpose, benefits, indications and complications for supplemental oxygen.
3. Describe the safe storage of oxygen equipment.
4. Perform the procedure for administering oxygen to a breathing or non-breathing patient.

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Oxygen

This section provides the basic theory for use of oxygen in treating a patient who has suffered a serious injury. Equipment will vary from centre to centre and training on the use of the oxygen equipment is the responsibility of each local ski centre.

Always ensure a clear airway before administering oxygen. Do not administer oxygen to a patient unless you have been trained by qualified personnel on how to use the proper equipment. Also, do not administer oxygen using units equipped with a positive pressure resuscitator. These devices can cause lung damage to the patient if used improperly.

Oxygen is a drug. Be cautious about when it is appropriate to administer it, how much to administer and be aware of what to expect.

Benefits of administering oxygen

Atmospheric air, the air around us, contains about 21 per cent oxygen. Oxygen is transported across the alveoli - air sacs - of the lungs to the red blood cells which in turn, carry oxygen to other cells of the body. Therefore, for cellular oxygenation to occur, both the respiratory and circulatory systems must be intact.

In cases of impairment to either system, administering oxygen may be beneficial as described below:

Impairment of circulatory system

When there is a deficiency in the circulatory system, there may be fewer red blood cells (hemorrhage) or they may be circulating inefficiently (shock). Administering oxygen increases the concentration of oxygen in the lungs resulting in more oxygen being absorbed by each red blood cell, delivering more oxygen to the cells. This in turn could compensate for the lower number of red blood cells in the circulatory system that occurs during trauma and may help reduce or prevent the progression of shock.

Impairment of respiratory system

During artificial respiration, oxygen concentration in the lungs is reduced from 21 per cent to 16 per cent. CPR maintains circulation at about 30 per cent of normal levels, which reduces oxygen concentration even further. While this is enough oxygen to keep a patient alive, administering oxygen in these cases increases oxygen concentration in the lungs resulting in an increase in the amount of oxygen available for the blood to carry to the cells.

This may improve the patient's survival chances.

Obtaining a clear airway takes precedence over giving oxygen.

Hypoxia

Hypoxia is a condition resulting from a decrease in the level of oxygen available to the cells. It is crucial that a patroller be able to recognize the signs and symptoms that indicate the onset of hypoxia.

The ultimate goal in treating hypoxia is to increase blood oxygen concentration and thus prevent the patient’s condition from deteriorating and developing into respiratory arrest or ultimately resulting in brain damage and death.

To avoid any such complications, first stabilize the condition causing the problem, and then administer oxygen to increase the oxygen concentration in the lungs. Hypoxia may be caused by CRASH.

Hypoxia - causes	
C	Cardiac
R	Respiratory
A	Altered level of consciousness
S	Shock
H	Head injury

Inadequate respiration

Inadequate respiration refers to insufficient amounts of oxygen exchange in the lungs. This could be caused by impure or insufficient air, an obstructed airway, chest injury, disease of the lungs, drug or alcohol misuse/overuse, or high altitude; all of which can lead to hypoxia.

Inadequate circulation

Inadequate circulation refers to a reduction in blood flow to the tissues. This could be caused by a heart attack, shock, severe bleeding or disease.

Cellular transport problems

Cellular transport problems refer to the reduction in the oxygen-carrying capacity of the red blood cells. This could be caused by a heart attack, shock, severe bleeding, disease or carbon monoxide, which competes with oxygen for transport.

Chronic bronchitis

Bronchitis occurs when long-term exposures to irritants, usually from smoking, causes the large and small airways to become inflamed. This irritation leads to increased mucus production and cellular changes in the mucosal wall. The condition is considered chronic if the person has a productive cough for more than three months per year for two years in a row. The patient must work much harder to breathe than a normal person. This increased effort can lead to respiratory distress and eventual respiratory failure.

Complications

Complications may arise from administering oxygen either for extended periods of time or if the patient is exposed to higher-than-normal levels of concentration of oxygen.

Oxygen toxicity (poisoning) occurs when the patient is exposed to high concentrations of oxygen. This can result in lung tissue destruction. This condition is rare in the pre-hospital environment. Taking a history first will reveal if the patient has had any prior extended exposure to oxygen.

Respiratory arrest can occur in cases where the patient suffers from chronic obstructive pulmonary disease (COPD) such as emphysema and chronic bronchitis, and is exposed to high concentrations of oxygen (close to 100 per cent) for extended periods of time (over 24 hrs).

These conditions are more common in elderly populations especially those with a long history of smoking.

Chronic obstructive pulmonary disease (COPD) and oxygen use

In normal lungs, the major stimulus to breathing is the concentration of CO_2 (carbon dioxide) in the blood. The airway of a patient with COPD becomes partially obstructed; their body adapts to a higher concentration of CO_2 in the blood. Therefore, the body's major stimulus for breathing becomes lower oxygen levels.

Take care while administering oxygen to a COPD patient. In rare cases, the stimulus to breathe may be compromised and the patient could stop breathing.

Patients suffering from COPD will alert you to their condition. Take a detailed history and monitor their condition while administering oxygen and get medical assistance as soon as you can. In an emergent respiratory situation, everybody could benefit from supplemental oxygen. When using a pulse oximeter, aim for a blood oxygen saturation level, known as SpO_2, of 88 per cent to 92 per cent for people with COPD (See Pulse Oximetry).

Oxygen equipment

Components

Most oxygen equipment systems will consist of a tank, regulator, hose and delivery device:

- The dome of the oxygen tank will either be green or white, and should have a yellow diamond marker saying oxidizer.
- A pressure regulator lowers the pressure from 2,000 psi (138 Bar) inside the tank to less than 50 psi (3.45 Bar). Most EMS style regulators incorporate a dial to allow for adjustment of oxygen flow rates (0.5 L/min – 15 L/min or 0.5 L/min – 25L/min). The regulators without a dial are set to one flow rate.
- A hose and a delivery device, such as a nasal cannula, a non rebreather or a partial rebreather mask.

Figure 5-1: O2 tank and regulator

Figure 5-2: Pressure regulator and flowmeter

Tank and pressure regulator

The pressure regulator has a pressure gauge that reads tank pressure. Oxygen regulators have a two pin index system that will not allow the regulator to be connected to the wrong type of tank.

There is a rubber O-ring or a plastic gasket between the regulator and the tank to maintain an effective seal.

Regulator and flowmeter

The flowmeter normally controls the output of oxygen to be delivered from one quarter up to 15 or 25 litres per minute(L/min) depending on the regulator.

Oxygen flow rates

Type	Patient	Use	Flowrate* (L/min)
Nasal cannula	Breathing	Low concentration	1/4 to 6
Partial rebreather mask	Breathing	Mid to higher concentration at moderate flow rates	6 to 10
Non-rebreathing mask	Breathing	High concentration	10 to 15
Pocket face mask	Non-Breathing	Moderate concentration	6 to 15
Bag valve mask	Non-Breathing	High concentration	10 to 25

*Always titrate (adjust) the flow rate to meet patient demands. Aim to maintain SpO2 at 94 per cent to 96 per cent when using a pulse oximeter.

Pocket face mask

A pocket face mask can deliver a moderate oxygen concentration (up to 50 per cent).

Figure 5-3: Pocket face mask with oxygen line

Figure 5-4: Face mask, non-rebreathing mask and cannula

Partial-rebreathing mask

Partial rebreathing masks are equipped with an oxygen reservoir. The patient draws oxygen from the reservoir. When the patient exhales, some of their exhaled volume will mix with the incoming oxygen in the reservoir. The patient will then rebreathe some of their exhaled air. The resultant mix of air and oxygen delivers a mid to high concentration of oxygen. The flow rate of the oxygen should be high enough that the reservoir does not totally collapse on inhalation.

Non-rebreathing mask

Non-rebreathing masks are equipped with an oxygen reservoir. The patient draws oxygen from the reservoir through a one- way valve. This mask delivers a higher concentration of oxygen because the patient does not rebreathe a part of their previous breath. The flow rate of the oxygen should be high enough that the reservoir does not totally collapse on inhalation.

Nasal cannula

Use a nasal cannula when the patient refuses a mask, has facial trauma that prevents a proper fit of the mask or is vomiting.

Insert the two soft tips into the nostrils, then place the tubing behind each ear. Slide the adjuster to keep the tubing in place. The cannula will deliver low concentrations of oxygen, and is used at the lowest setting on the regulator up to 6 L/min.

Storage and handling of oxygen equipment

Due to the various sizes of oxygen cylinders, the duration of the tank's use is directly related to its litre capacity and the flow rate (L/min) that is being used. The maximum pressure most commonly used is 14 800 kPa (2,000 psi) when full and anytime the tank gets down to below 2,800 kPa (400 psi) it should be refilled.

There are a variety of oxygen delivery products in use, you only need to familiarize yourself with the specific equipment available where you patrol. Generally speaking, there are three common sizes you are likely to encounter; they are "D", "E" and "M" tanks. D tanks are the most common size for portable units, E tanks are usually on two wheeled carts, slightly longer than "D" tanks and are used in clinics, and M cylinders are used in facilities where oxygen is used more frequently. The duration of the D cylinder is approximately 20 minutes, an E cylinder approximately 30 minutes and the duration of an M tank is approximately three hours, at a flow rate of 15 litres per minute.

All tanks regardless of design have a valve for turning the tank on and off. Clockwise closes the tank and to open it you only have to give it a quarter to half turn counterclockwise and it will be completely open. After shutting the tank valve, reopen the flow regulator to bleed (release) the pressure out of the rest of the system.

When the oxygen delivery system has been used at your area, the non-disposable parts need to be cleaned and decontaminated (see Cleaning ventilation equipment in chapter 6). Any disposable parts should be double bagged and left in a biohazard waste receptacle at your local hospital or facility.

Safe handling of equipment

Handle tanks with care. Do not drop or puncture the tank as it could turn it into a projectile.

Do not use oxygen around an open flame, spark, or in an area where people are smoking. Oxygen supports combustion.

Never allow petroleum products, such as grease or oil, to come in contact with oxygen under pressure. The mixture can promote ignition.

Proper oxygen tank setup

Before administering oxygen, you must first prepare the equipment by following the steps below:

1. Make sure the tank contains oxygen. Check the label, the neck tag, and the colour.
2. Remove the shipping seal from the valve stem and save the gasket.
3. Open the tank valve for one second to clean debris from the valve.
4. Make sure the regulatory pins on the regulator match the holes on the valve stem of the tank.
5. Insert the gasket into the large cylinder opening.

6. Align the pins on the regulator with the holes on the neck of the oxygen cylinder. Install the regulator and tighten sufficiently for the regulator to hold solidly in place, without over-tightening.
7. Make sure the flow dial on the regulator is set at “0”.
8. Open the cylinder (turn counter-clockwise).
9. If oxygen is heard escaping, turn off the tank, check that the O-ring is centred in the oxygen outlet on the valve stem and re-align the regulator and open the cylinder (turn counter-clockwise).
10. If no sound is heard, turn on the flow regulator to make sure that the regulator is working.
11. If oxygen is flowing, turn off the tank at the valve stem.
12. Set the flow back to “0”.
13. The oxygen tank is now ready to use.

Oxygen administration

Oxygen can be administered to breathing patients or non-breathing patients.

Administering oxygen to a breathing patient

Follow the steps below if administering oxygen to a breathing patient:

1. Explain the procedure to the patient.
2. Attach the delivery device to the flowmeter.
3. Set the required flow rate.
4. Check to see if the delivery device is functioning properly.
5. Place the delivery device on the patient and have them mimic your breathing.
6. Advise patient to take slow deep breaths.
7. Adjust the flow rate to maintain an SpO_2 between 94 per cent and 96 per cent.
8. Secure the equipment for transport.
9. Monitor vitals and maintain airway continually.
10. Be prepared to do artificial respiration in case of respiratory arrest.

Nasal cannulas do not deliver as much oxygen as a mask. However, some patients cannot tolerate a mask (e.g. claustrophobia), making a cannula an acceptable option.

If the patient cannot tolerate wearing the face mask, switch to a nasal cannula and lower the flow rate. If this is not tolerated, have the patient hold the mask close to their face. This does not deliver the same concentration of oxygen as wearing the mask but they may get some benefit from the oxygen.

When the patient no longer needs oxygen administration:

1. Remove the delivery device from the patient's face.
2. Close the main regulator valve.
3. Refer to the manufacturer's documentation and follow the proper shutdown procedure for the equipment being used.

Administering oxygen to a non-breathing patient

Oxygen can be administered to a non-breathing patient using a pocket face mask or a bag-valve mask resuscitator (BVM). These units connect directly to the oxygen equipment by a delivery supply tube. For BVM and pocket mask instructions see Chapter 6.

For patients requiring rescue breathing, use two-patroller BVM procedures so that one patroller can focus on keeping the mask in place and maintain the seal. If there is only one patroller, use a pocket face mask.

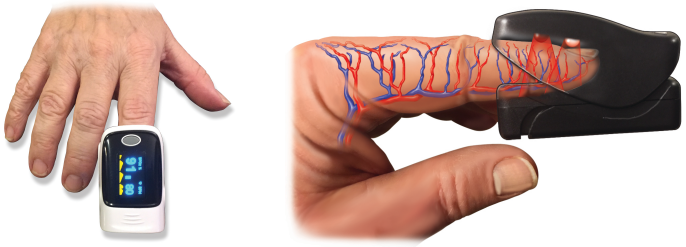
Pulse oximetry

Pulse oximetry is a non-invasive method of monitoring a person's oxygen saturation. A pulse oximeter is a device that uses light to measure the percentage of saturated hemoglobin in blood, ideally with oxygen. The advantage of pulse oximetry is that low saturations of oxygen can be detected earlier than by clinical indicators such as skin colour changes.

The device will display the patient's heart rate (beats per minute), the degree of hemoglobin saturation as a percentage and some will display a waveform of the pulse waves. The evolution of pulse oximeters has resulted in units that are quite accurate, convenient to use, lightweight and inexpensive to purchase.

Pulse oximeters are best used indoors, with patients who have good peripheral blood flow. It is important to remember that the oximeter is measuring hemoglobin saturation, not the quality of patient ventilations. Saturations in the range of 94 to 99 per cent are considered normal at sea level, reducing by 4 per cent at 1830 m (~6000 ft). The use of supplemental oxygen should be considered for consistent saturations below 94 per cent.

Cold hands, nail polished finger nails and low peripheral blood flow will result in false low readings. Exposure to carbon monoxide or cyanide will result in false high readings on the oximeter.



Figures 5-5: Pulse oximeter.

Conclusion

Administering oxygen to patients in distress may help reduce the progression of shock and could improve their speed of recovery. Handle oxygen with care. Monitor the patient continually until further medical assistance arrives or the patient is transported to another medical service.

6. Basic life support

Learning outcome

Describe, understand, and demonstrate basic life support techniques.

The CSP requires new candidates to successfully complete a CPR BLS/AED evaluation as part of the AFA qualification process. Returning patrollers are required to successfully complete a CPR BLS/AED requalification session, including written exam, on an annual basis. A CPR BLS/AED qualification card may be issued upon completion.

Upon completion of this chapter, you should be able to:

1. Recognize the signs and symptoms of airway, breathing and circulatory problems.
2. Demonstrate airway management, including relief of airway obstructions, for adults, children, and infants.
3. Demonstrate both one- and two-person cardiopulmonary resuscitation (CPR) for an adult, child and infant.

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Basic life support

The basic life support techniques that are described in this chapter are developed from guidelines produced by the International Liaison Committee in Resuscitation (ILCOR).

Basic Life Support (BLS) generally refers to the type of care that first-responders (including CSP AFA trained members), healthcare providers and public safety professionals provide to anyone who is experiencing an obstructed airway, respiratory distress or cardiac arrest. It requires knowledge and skills in cardiopulmonary resuscitation (CPR), using an Automated External Defibrillator (AED) (see Chapter 7) and relieving airway obstructions in patients of every age (adult, child, infant).

The following age groupings for BLS are based on evidence-based research specific to BLS.

Age classification	
Category	**Age**
Infant	Up to one year old
Child	One year old up to puberty onset
Adult	After puberty

Basic life support consists of several life-saving techniques related to:

- **Airway**: the protection and maintenance of a patient's airway
- **Breathing**: the actual flow of air through either natural or artificial respiration
- **Circulation**: the movement of blood due to the heart beating or the emergency application of CPR

Airway obstruction, cessation of breathing, or cardiac arrest endangers life. These conditions require immediate resuscitation. Without sufficient oxygen, the brain will begin deteriorating within minutes.

Clinical and biological death

Arrested respiration and the lack of oxygen in the blood for four to six minutes will result in damage to brain cells. In rare cases, people have been resuscitated after their vital signs have been undetectable for periods of 20 minutes or more with no ill effects. However, these survivors usually went into cardiac and respiratory arrest under conditions where a cold environment was involved, such as immersion in cold water which caused hypothermia.

Hypothermia can cause the body function to slow because of the cold and thus reduces the need for oxygen to such a low level that deterioration of the cells takes longer than it would in a normal environment (see "Hypothermia" Chapter 17).

Clinical and biological death		
Clinical death		
Respiratory and cardiac arrest		
Time to onset (minutes)	0 to 4	4 to 6
Brain damage due to hypoxia	Not likely	Likely
Biological death		
Irreversible brain damage probable		
Time to onset (minutes)	6 to 10	>10
Brain damage due to hypoxia	Probable	Almost certain

Airway – causes of airway problems

Anatomical obstruction

Anatomical obstructions can cause respiratory failure or inadequate ventilation. The most common cause of anatomical obstruction for an unresponsive patient is obstruction by the tongue. It is also the least complex problem and easy to fix.

Mechanical obstruction

Mechanical obstructions result when a foreign object blocks the airway passage. Typical examples of mechanical obstructions are vomitus blockage or a solid foreign body such as a toy, tooth, broken denture, or piece of food.

It is impossible to rectify breathing problems if the patient's airway is not clear. Therefore, identify and rectify airway problems first before going on to the next stage.

Breathing – causes of breathing problems

Medical problems

Respiratory failure can be caused by spasms of the larynx, asthma, pneumonia, emphysema or anaphylactic reactions. Asthma is the most common amongst these conditions.

Trauma

Injuries such as blows to the head, throat or chest may cause respiration problems.

Lack of oxygen

Insufficient oxygen supply (hypoxia) causes respiratory arrest. Asphyxiation occurs when a patient is forced to breathe with an inadequate oxygen level or when there is an obstruction of the airway.

Poisoning

Respiration-depressing drugs, such as codeine, morphine, barbiturates and alcohol, can result in the patient not breathing. Inhaled poison, gases and smoke can cause inflammation and swelling of the airway.

Agonal breathing

Agonal breathing, or agonal respiration, is not true breathing.The gasping associated with agonal breathing is a result of the brainstem reflex caused by running out of oxygen due to cardiac arrest or a stroke. The desperate gasping for air is usually a symptom of the heart no longer circulating oxygenated blood, or there's an interruption of lung activity that's reducing oxygen intake. It can often signal that death is imminent.

Agonal breathing may sound like gasping, grunting or noisy breathing with accessory muscle or abdominal movement. It is not normal regular breathing. You will not see the chest go up and down as in regular breathing, and you will not hear regular breathing when you look and listen. Agonal breathing may last only a few breaths or can last for a few hours, depending on the cause.

Responders can usually recognize when the patient's breathing is abnormal but fail to recognize that what they are actually seeing is agonal breathing. Breathing that is found to be too fast, too slow or ineffective (agonal) requires immediate intervention.

Other major causes of respiratory emergency include:

- swelling as a result of burns to the face and the inhalation of heated air can block air exchange
- drowning
- shock
- altitude sickness
- electrocution

Signs and symptoms of airway and breathing problems:

- an absence of, or irregular movement of the chest wall and abdomen
- abnormal breathing sounds (whistling or high-pitched wheezing)
- irregular respiration rate or rhythm
- cyanosis (blueness of the skin) - for people with a dark complexion look inside the mouth, check finger nail beds, palms of hands and eyes.

Circulation – causes of circulation problems

Regulatory mechanisms

Impaired breathing can result in changes in the oxygen level (i.e., lack of oxygen) and balance between acid and base in the blood which can result in the brain quickly losing its ability to regulate circulatory mechanisms.

Heart attack

An inadequate blood supply to the cardiac muscle due to an obstruction of a coronary artery causes damage to the heart muscle resulting in impaired cardiac function.

Stroke

A cerebral vascular accident (CVA) is the result of a reduction of the supply of blood to a section of the brain usually caused either by a blood clot or bleeding within the brain.

Shock

Hemorrhage causes a decrease in the effective blood volume resulting in shock.

Electric shock

An electric current or lightning may disrupt the normal rhythms of the heart or stop it, thus disrupting the normal circulatory system.

Signs and symptoms of circulation problems:

- cyanosis (blueness of the skin)
- increased respiratory rate
- abnormal pulse rate and character
- shallow breathing
- pale, cool, and clammy skin
- absent radial or carotid pulse
- drop in blood pressure

Activating emergency medical services

Contact the designated emergency medical services (EMS) in the following situations:

- If the patient requires a level of medical attention that you cannot possibly provide because of the scope of training you received.
- If you assess that facilities at hand are not adequate to provide the proper medical attention to the patient.

In either case, the well-being of the patient may be compromised if EMS is not contacted.

Another secondary role to contacting EMS is to provide on-lookers with a useful function while you concentrate on treating the patient.

Follow these steps when activating EMS:

1. If you are not alone, ask a bystander to activate EMS (i.e., call an ambulance, 9-1-1). If using a mobile phone, use the speaker mode, which will allow you to communicate directly with the dispatcher and both give your precise location and take direction from the dispatcher.
2. If a mobile phone is not available, have a bystander to find a phone or person with a mobile phone, make the call, and then return to you and verify that the call has been made and any instructions from the dispatcher. The bystander is then free to assist in any other appropriate way.
3. Ensure that the bystander can briefly describe the nature of the emergency, e.g.,unresponsive female adult, not breathing; unresponsive child not breathing; responsive elderly male with an apparent heart attack; CPR in progress; etc.
4. If an AED is available, when possible have a bystander bring it to you so that you do not need to leave the patient.

If you are alone with an unresponsive patient, the patient should be placed in the semi-prone recovery position if you have to leave them to activate EMS. Get an AED, if available, after you activate EMS.

If alone with a child or an infant, initiate the necessary resuscitation techniques for two minutes or five cycles, then activate EMS, continue until help arrives or until you are too tired to continue.

Mobile technology and social media applications that notify patrollers of a nearby cardiac arrest may increase the rate of bystander-initiated CPR.

Managing the airway

The most important task in performing BLS is to open and maintain a clear airway to re-establish effective breathing.

The following methods to establish and maintain an airway will be used throughout the procedures described later in this chapter for managing obstructed airways (choking), artificial respiration (AR) and cardiopulmonary resuscitation (CPR). Understanding these methods will help in the assimilation and mastering of the various sequences to come.

Opening the airway

Many unresponsive patients do not require artificial respiration, but rather proper positioning of the head to allow adequate natural breathing through an open airway.

Head tilt – chin lift

This is the recommended way to open the airway if no spinal/head injury is suspected.

Place the palm of the hand closest to the head on the patient's forehead and apply firm, backward pressure to tilt the head back. At the same time, lift the chin by placing the fingers of the other hand under the bony part of the lower jaw near the chin.

The fingers must not press deeply into the soft tissue under the chin, which might obstruct the airway.

Tongue jaw lift

Place a thumb in the mouth and grab the jaw, lifting the mandible up and out. Use the other hand to stabilize the head. Do not hyper-extend the neck. Used when doing the finger sweep.

Jaw thrust

This method must be used in the case of a suspected cervical spine injury without tilting the head back or moving the patient's head.

Place the fingers of both hands behind the angle of the patient's lower jaw and lift, forcing the mandible forward without tilting the head back.

Figure 6-1 Head-tilt chin-lift

Figure 6-2 Tongue jaw-lift

Figure 6-3 Jaw-thrust.

Oropharyngeal airways

The most common obstruction in an unresponsive patient is their tongue. An oropharyngeal airway (OPA) is a curved device inserted into the mouth of an unresponsive patient to keep the tongue from blocking the airway.

OPAs come in different sizes. Size the OPA by measuring the distance between the earlobe to the corner of the mouth. Before inserting an OPA, you should already be maintaining an open

airway. If doing a head tilt - chin lift, make sure the patient is unresponsive and does not have a gag reflex by seeing if they have a reaction to touching their eyelashes. If a reaction is noticed, do not use an OPA.

Figure 6-4: Sizing an OPA

OPA insertion for adult and child:

1. Size the OPA to the patient.
2. Check for dentures or dental appliances, remove if loose.
3. Perform head-tilt chin-lift, or jaw thrust technique for potential c-spine compromised patient.
4. If required use cross-finger (scissor) technique to open mouth.
5. Insert the OPA into the mouth with the curved end towards the roof of the mouth.
6. Slowly move the airway toward the back of the mouth, until the distal end reaches the soft palate (a soft rebound can be felt through the OPA).
7. Rotate the airway 180°. It should slide into its proper position, with the flange resting on the lips.
8. If gagging, retching or vomiting occurs, remove the OPA immediately!
9. Prepare to use suction to clear the airway.

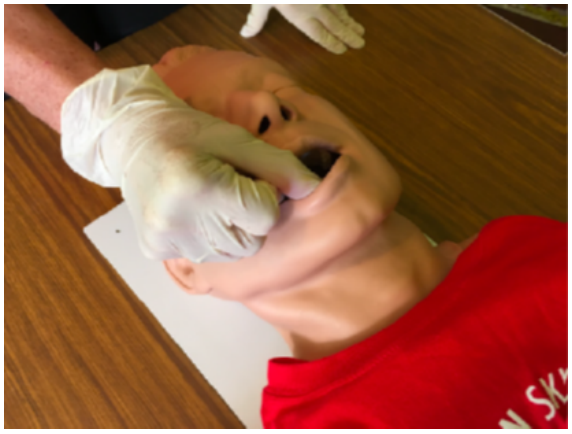

Figure 6-5: Cross-finger (scissor) method

Cross-finger (scissor) technique

Place the thumb of one hand on the patient's upper or lower row of teeth near a corner of their mouth. Place the index finger on the opposite row of teeth so the digits will cross when the patient's mouth is opened.

Push the thumb and index finger against the patient's upper and lower teeth in opposite directions in a scissor-like motion until their mouth opens.

It is not advisable to place fingers inside a patient's mouth without a bite stick in place to prevent being bitten. In the absence of a bite stick, a second OPA can be used as a bite stick. The bite stick should rest in the corner of the patient's mouth as a guard to stop the mouth from closing on your fingers.

OPA insertion for an infant and small child:

1. Size the OPA to the patient.
2. Insert OPA holding the tongue down using a tongue depressor, and follow the natural curvature of the mouth. There is no need for the cross-finger (scissor) method.
3. If gagging, retching or vomiting occurs, remove the OPA immediately!
4. Prepare to use suction to clear the airway.

Suction

Suction devices are used to remove fluids and vomit from the airway. Although there are many devices on the market, they share common instructions and precautions for use. Suction is applied only to the oral cavity and upper airway. Insert the tip of the device into the mouth over the tongue. Never place the suction tip beyond where you can see; in other words, no blind suctioning. Apply suction for five to 10 seconds, while the tip is being withdrawn. Ensure that the patient is ventilated and oxygenated between suction attempts.

All suction equipment should be kept clean, and preferably sterile. This can be managed by keeping whatever method of suctioning you elect to use in sealed containers or bags. Once the suction has been used the equipment must be cleaned (see Cleaning ventilation equipment later in this chapter).

The following are signs and symptoms that would require the use of suction:

- decreased level of consciousness (LOC)
- facial injuries involving the mouth or nose
- any person whose ventilations are being assisted
- any time an OPA is used

Prior to using any suction equipment make sure that it functions properly and is complete.

Suctioning the mouth:

- When suctioning, do not suction for any longer than five to 10 seconds at a time.
- Positioning is important.
- Set yourself at the head of the patient looking down the body.
- When c-spine precautions are not a concern, turn the head to the side to aid in drainage while suction is performed.
- If c-spine is a concern, suction the patient in the supine position.
- Take into account that the patient may not be able to protect his or her airway.

- Do not allow fluids to build to the point where the airway is totally compromised.
- Continually monitor the airway and suction fluid as necessary.
- When suctioning, always start at the rear, or farthest point from the lips and work forward to the outside.
- Never place the suction tip beyond where it can be seen.

Suction devices

If using a bulb type suction device, squeeze the bulb prior to inserting into the mouth. Then slowly release the bulb while withdrawing it.

It may be necessary to repeat this procedure several times until all the fluid is removed. If using suction units, such as the V-Vac, Res-Q-Vac or similar devices, remember to place the tip in the mouth within sight and to continuously pump the handle until all secretions are removed. Again, bear in mind the time frame. If you are assisting ventilations, it will be necessary to suction for only five seconds and then give the patient a breath. If you are doing CPR the same rule applies. Intersperse the suctioning with the ventilations. Do not interrupt compressions for more than 10 seconds.

It is your responsibility to familiarize yourself with the available devices at your respective facilities and to ensure that you have received proper training on the specific device.

Choking (foreign body airway obstruction)

The most common cause of choking in adults is airway obstruction caused by food. In infants and children, cases of choking occur while eating or with non-food items such as coins or small toys.The patient may use the standard distress signal of clutching their hands to their throat to indicate an airway obstruction.They may begin to turn blue and will be very frightened. Identify yourself as a trained first aider and ask the patient, “Are you choking?”

When helping a responsive person, patrollers must be able to recognize the signs of partial choking and complete choking.

Partial choking

Signs of partial choking:

Determine if the patient is suffering from partial choking by looking for the following signs:

- the ability to forcibly cough
- wheezing between coughs

A patient with partial choking should be monitored until they improve as it could develop into complete choking.

Treatment for partial choking:

1. Encourage the patient to try and dislodge the object by coughing.
2. Do not attempt abdominal thrusts, chest thrusts or back blows.
3. Never interfere with the patient's efforts to clear the airway.
4. Stay with the patient until the object is expelled and breathing is normal.
5. Monitor vital signs.
6. If the condition persists, activate EMS.
7. If the patient becomes unresponsive, treat the situation as a complete choking.

Complete choking

Signs of complete choking:

Determine if the patient is suffering from complete choking by looking for the following signs:

- inability to speak, breathe or cough
- absence of chest movement or air exchange
- increased cyanosis

The inability to produce any sound indicates complete choking and the need for immediate action. Without oxygen the patient may soon become unresponsive. Within four to six minutes brain damage may occur.

Activate EMS in all cases of complete choking.

Complete choking treatment – responsive adult and child

If an obstruction cannot be removed willingly by a responsive patient (e.g.,by coughing), it must be expelled by making use of the trapped air that remains in the patient's lungs.

In responsive adults and children who are choking, abdominal thrusts, chest thrusts, and back blows are equally effective.

Abdominal thrusts, back blows, and chest thrusts should be applied in quick succession until the object has been cleared from the airway or the patient becomes unresponsive. Each thrust should be distinct and delivered in such a way to expel the foreign body out of the airway. More than one technique may be needed in responsive adults and children.

Although injuries have been reported after using an abdominal thrust, there is not enough evidence to determine whether chest thrusts, abdominal thrusts or back blows should be used first on responsive adults and children.

With the exception of positioning and applied force, abdominal thrusts, chest thrusts, and back blows are administered in the same fashion for both adults and children.

There is not enough evidence to suggest a different approach for an obese or pregnant person who is choking.

Figure 6-6: Abdominal thrust position for choking adult or child.

Abdominal thrusts

Administer abdominal thrusts to a standing or sitting patient in the following manner:

1. Position yourself behind the choking patient.
2. Wrap your arms around their waist.
3. Make a fist with one hand.
4. Place the thumb side against the abdomen above the navel but well below the sternum. Grasp this fist with the other hand.
5. Administer five quick inward and upward thrusts to the abdomen.

Figure 6-7: Back blow position for choking adult.

Back blows

Administer back blows to a standing or sitting patient in the following manner:

1. Position yourself behind the choking patient.
2. Place one arm across the patient's chest and bend the patient forward.
3. Use the heel of your other hand to deliver five firm blows between the shoulder blades of the patient.

Chest thrusts

Administer chest thrusts to a standing or sitting patient in the following manner:

1. Position yourself behind the choking patient.
2. Wrap your arms around their chest.
3. Make a fist with one hand.
4. Place the thumb side against the mid-sternum (CPR position). Grasp this fist with the other hand.

Figure 6-8: Chest thrust position for choking adult.

5. Administer five quick backward pulls to the chest. Each thrust should be distinct and delivered in such a way to expel the foreign body out of the airway.

Complete choking treatment – unresponsive adult and child

If an adult or child becomes unresponsive, begin CPR starting with chest compressions (see CPR) to clear the foreign body from their airway. Check inside the mouth every 30 compressions.

The finger sweep method may be used in unresponsive adults and children to clear a foreign body from their airway, providing that the object is solid and visible in the airway.

Figure 6-9: Infant back blows and chest thrusts.

Complete choking treatment – responsive infant

1. Pick up the infant while supporting the head and the rest of the body.
2. Place the infant face down, supporting their body on your thigh (hook the infant's leg between your arm and body). Ensure the infant's head is well supported and lower than the trunk.
3. Administer five back blows between the shoulder blades with the heel of your hand.

4. Turn the infant face up, supporting their body on the opposite thigh (hook the infant's leg between your arm and body). Ensure the infant's head is well supported and lower than the rest of the body.
5. Place two fingers in the middle of the infant's chest between the nipples and slide the fingers to just below the nipple line.
6. Administer five chest thrusts with the two fingers. Press down quickly with the two fingers on the centre of the chest.
7. Repeat the back blows chest compressions sequence until the object is cleared from the airway or the patient becomes unresponsive.

Complete choking treatment – unresponsive infant

If the infant becomes unresponsive, start infant CPR. Check inside the mouth for an expelled object every 30 compressions.

Only remove solid material in the airway using a finger sweep if you can see it. Do not blindly sweep the mouth with your fingers.

Finger sweep

Finger sweep must be avoided unless you can see the object when opening the patient's mouth. This rule is applicable for the adult, child and infant. Always be mindful that a too hasty or forceful action may insert the obstruction more solidly. This is especially true of children and small-framed adults. Look first. Try to identify the obstruction visually (e.g., dislodged dentures or false teeth).

Check the mouth with a tongue jaw lift and finger sweep:

1. Grasp both the tongue and the lower jaw between the thumb and the fingers.
2. Lift the mandible.
3. If the object can be seen, insert the index finger of the other hand down along the inside of the cheek and sweep the throat at the base of the tongue.
4. Carefully scoop out the obstruction.

Figure 6-10: Finger sweep.

Only perform the finger sweep procedure when you can see the obstruction. In the case of an infant use your small finger to carefully remove the obstruction.

Points to remember

- Assessment and recognition of choking are very important. Partial choking with air exchange means that the patient can:
  - cough
  - speak
  - grunt
  - cry
  - make a noise
- Never interfere with a responsive patient's own attempts to expel the foreign body.
- When practicing on a partner, simulate the abdominal thrust and chest thrust motions and take great care with all manoeuvres to prevent damage to vital organs.
- If you suspect a cervical spine injury, do not tilt the head. Use the jaw-thrust method to open the airway.
- A patient with an obstructed airway, who is alone, may perform abdominal thrusts on themselves by leaning across the back of a chair or counter and rapidly pressing their abdomen heavily, increasing pressure.
- A seated patient with an obstructed airway, is treated the same as a standing patient. If the chair is too large to get your arms around the patient, place the patient on the floor.
- After having abdominal or chest thrusts performed on them, all patients should be seen by a medical doctor.

Artificial Respiration (rescue breathing)

Artificial respiration (AR), also known as rescue breathing, refers to respiration simulation where air is provided to a patient who is not breathing or is incapable of breathing at a normal rate on their own. AR must be started immediately in the case of respiratory arrest and at the first signs of lack of oxygen.

There are several methods of AR. Direct methods involve ventilating the patient's lungs by making a seal between your mouth and the patient's mouth and blowing, or by using a mechanical device such as a bag valve mask (BVM).

Protect yourself from body fluids by using a pocket face mask or other barrier device, if available. You must be trained and have practiced using them.

Once started, continue to use artificial respiration until one of the following occurs:

- spontaneous breathing returns
- another trained patroller can take over
- you are unable to continue
- the patient is declared dead by appropriate medical personnel

Ventilating

Ventilating is the action of exhaling breath from the patroller into the patient.

When ventilating, and in order to minimize excess air going into the stomach (gastric distention), consider the size of the patient and limit the volume to what is required to make the chest clearly rise.

In order to enable you to continue ventilating the patient for a period of time without hyperventilating, you must also consider the normal respiratory rates for the age group of the patient and your own. Ventilation rates vary depending on the patient's age. Established duration and rates at which each breath is given are described in the table:

Ventilation			
Age group	**Rate**	**Duration per breath**	**Volume**
Infant	One every two - three seconds (20 - 30 /minute)	One second	Until the chest clearly rises
Child	One every two - three seconds (20 - 30 /minute)	One second	Until the chest clearly rises
Adult	One every five - six seconds (10 - 12 /minute)	One second	Until the chest clearly rises
Caution: An infant's lungs can be easily damaged. Use gentle puffs and do not over inflate.			

Gastric distention is an accumulation of air into the stomach. This is usually caused by giving too great a volume of air during ventilation, forceful ventilation or an improper positioning of the airway. The usual sign is the distention of the abdomen (bloating) hence the term gastric distention.

If this condition is noticed:

- reposition the airway
- reduce the volume of air of each breath only to the extent that the chest is seen to rise

Do not attempt to expel the air from the stomach. This could cause the patient to vomit and aspirate the stomach contents into the lungs.

Ventilation equipment

There are several devices used to provide ventilation, including:

- pocket face mask, see Chapter 3, or similar barrier device
- bag valve mask (BVM)
- oropharyngeal airway (OPA)
- non-rebreather mask or other oxygen delivery equipment, see Chapter 5
- intra oral mask (IOM)

Other devices may be used at your facility. It is your responsibility to familiarize yourself with the available devices at your respective facilities and to ensure that you have received proper training on the specific device.

Cleaning ventilation equipment

Any disposable parts should be double bagged and left in a biohazard waste at the local medical facility.

Reusable parts can be cleaned by washing the equipment with soap and warm water and rinsing thoroughly with clean water. The parts should then be soaked for 60 minutes in a solution of one part vinegar to three parts water. After soaking, the parts should be rinsed thoroughly with clean water and left to air dry on a clean surface.

Masks may be left in the first aid kit and checked on a monthly basis. "Single use only" masks or valves should never be re-used.

Ventilating with a pocket face mask/mask-to-mouth

Using a pocket face mask to perform ventilation is the recommended method.

1. Position yourself at the top of the patient's head looking towards their feet.
2. Place the bottom of the mask between the patient's lower lip and chin. This retracts the lip downward and holds the mouth open.
3. Seal the mask onto the patient's face using your thumbs along both sides of the mask.
4. Grasp the chin just beneath the angle of the mandible with your fingers and pull upward using a combination of head tilt and jaw thrust. If a neck injury is suspected, use the jaw thrust without tilting the head.
5. Breathe into the mask. The chest will rise.
6. Let the patient exhale through normal relaxation of the rib cage.
7. Look at the chest fall and listen for the patient's exhalation.
8. Allow the air to escape before repeating.

Figure 6-11: Mask-to-mouth.

For an infant, rotate the mask 180 degrees so that the nose portion of the mask points towards the infant's chin or use a mask from a pediatric BVM and your one way valve.

Alternative grip

The “double C-E” grip may be used. Using the “double C-E” grip to hold the patient's face up and into the mask ensures that occlusion of the airway is avoided and an adequate mask seal is maintained.

With one hand, use the forefinger and thumb to make the shape of the letter C.The remaining three fingers will naturally form the shape of the letter E. Do the same with the other hand to form another C and another E.

The seal is made by applying vertical pressure around the circumference of the mask using both Cs. The thumbs and forefingers of the Cs could overlap each other with larger hands. The jaw thrust is maintained by the remaining three fingers of both hands forming the Es.

Ventilating with a bag valve mask (BVM)

A single patroller providing ventilations should use the mask-to-mouth ventilations technique. In situations where at least two patrollers are available to support ventilations, and are properly trained, the two-person BVM technique is preferred. The BVM device consists of:

- a self-inflating bag
- a one-way valve
- a mask

Figure 6-12: BVM with double thumb push grip

Figure 6-13: BVM with double C-E grip.

Adult and pediatric size BVM devices are available. They differ in the size of the mask and the self-inflating bag.

An oxygen reservoir can be attached to the BVM if supplemental oxygen is available and warranted. For use of oxygen see chapter 5.

The first patroller maintains an open airway and a tight seal; the second patroller provides ventilations by squeezing the bag.

For someone breathing fewer than eight times per minute, assist their ventilations at a rate of one breath every five seconds, or 12 per minute. To assist a person breathing more than 30 times per minute, ventilate them every second breath.

It can be very difficult to assist someone that is already having difficulty breathing. Each ventilation must be timed as the person takes a breath in. When assisting a conscious person, focus on nothing but monitoring their respiratory rate and provide constant reassurance to them. Most people in respiratory distress will fight the thought of placing something over their face and this can become more difficult to manage the longer they are in respiratory distress.

Tracheostomy (neck breather)

Tracheostomy

A tracheostomy or stoma is the hole created in the neck of a person who has undergone a tracheotomy. The stoma may be permanent or temporary depending on the circumstance surrounding the reason for the procedure.

Figure 6-14: Stoma (with and without tracheostomy tube)

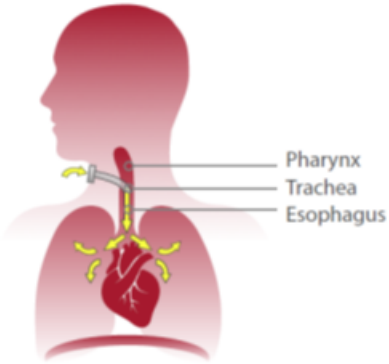

Figure 6-15: Total neck breather.

Laryngectomy

A person who has had a laryngectomy is usually a survivor of cancer of the larynx (voice box). In a small percentage of cases, it may be the result of injury, burns or infection.

Total laryngectomy (total neck breather)

A total neck breather is someone who breathes only through the neck opening and has no connection between the lungs and the nose or mouth; the larynx is usually absent.

Partial laryngectomy (partial neck breather)

A partial neck breather is someone who breathes mainly through the neck opening but still has a connection between the lungs and the nose and mouth.

There may or may not be a metal or plastic tube (tracheostomy tube) in the neck opening.

In all cases, they look the same on the outside of the neck, therefore you should not assume that there is not a pathway for air to escape through the nose and mouth.

The nose and mouth should always be sealed while performing rescue breathing to a stoma or tracheostomy tube.

Figure 6-16: Stoma

Figure 6-17: Use of face shield with stoma

Figure 6-18: Pediatric mask to stoma.

Regardless of whether the patient is a total or partial neck breather use the following technique:

Ventilations to stoma

1. Look, listen and feel at the neck for 10 seconds to determine if the patient is breathing.
2. Determine if patient has a tube in their stoma.
    a. If the patient has a stoma without metal or plastic tube:
        - Seal the patient's mouth and nose with your hand.
        - Clear the stoma and surrounding area of secretions.
        - In some cases, there may be a plastic plug in the stoma. If there is, remove the plastic plug before initiating rescue breathing.
        - Place a barrier device (face shield or mask from pediatric BVM) over the stoma and make a seal.
    b. If the patient has a tube in their stoma (also known as a trach-tube):
        - Use an intra oral mask (IOM), one-way valve from a pocket mask or BVM.
        - If there is a cover or valve attached to the tube, remove it.
        - If suction is available, suction secretions from the inside of the tube. Do not insert a suction catheter further than the length of the trach-tube.
        - Attach the barrier device to the trach-tube (IOM, one-way valve or BVM).
        - Seal the patient's mouth and nose with your hand.

- Give the patient a breath using the barrier device.

3. Release the seal over the mouth and nose, let the patient exhale through normal relaxation of the rib cage.
4. Look for chest fall and listen for patient exhalation at stoma.
5. Allow air to escape before repeating.
6. Ventilate at the usual rates depending on the age category of the patient.

It may be difficult to detect a carotid artery pulse in the neck of some people who have a stoma because of damage to arteries caused by laryngeal cancer treatment. If a pulse is not detected look for other signs of circulation and check for a pulse at the radial artery.

Ventilating without a barrier device

As infectious diseases are ever present, the patroller must be aware of the consequences. In the absence of a proper barrier device, putting your unprotected mouth on a patient is not advised. Do so at your own risk.

It is recommended to carry a barrier device of some kind.

Mouth-to-mouth

1. Use the jaw thrust or head tilt - chin lift method to establish an airway.
2. Look, listen and feel for 10 seconds to determine if the patient is breathing.
3. At a comfortable distance, kneel beside the head and shoulders of the patient.
   - If using the head tilt - chin lift method: seal the nose by pinching the nostrils with the hand on the forehead.
   - If using the jaw-thrust method: seal the nose by placing your cheek against the patient's nose.
4. Take a breath and seal the open lips of the patient with your mouth.
5. Give the patient a breath by exhaling into their mouth.
6. Release the seal; let the patient exhale through normal relaxation of the rib cage.
7. Look at the chest fall and listen for the patient's exhalation.
8. Allow the air to escape before repeating.

Mouth-to-mouth and nose

This technique is identical to mouth-to-mouth, discussed above.

Use mouth-to-mouth-and-nose on infants, small children, or in situations where this will give superior ventilation.

Mouth-to-nose

Use mouth-to-nose in situations where, due to trauma to the mouth, it is impossible to use the mouth-to-mouth or mouth-to-mouth and nose techniques.

1. Use the jaw thrust or head tilt - chin lift method to establish an airway.
2. Look, listen and feel for 10 seconds to determine if the patient is breathing.
3. Seal the mouth by placing your gloved hand over the patient's lips.
4. Take a breath and seal the nose of the patient with your lips.
5. Give the patient a breath by exhaling into the patient’s nose.
6. Release the seal over the nose and mouth; let the patient exhale through normal relaxation of the rib cage.
7. Look at the chest fall and listen for the patient's exhalation.
8. Allow the air to escape before repeating.

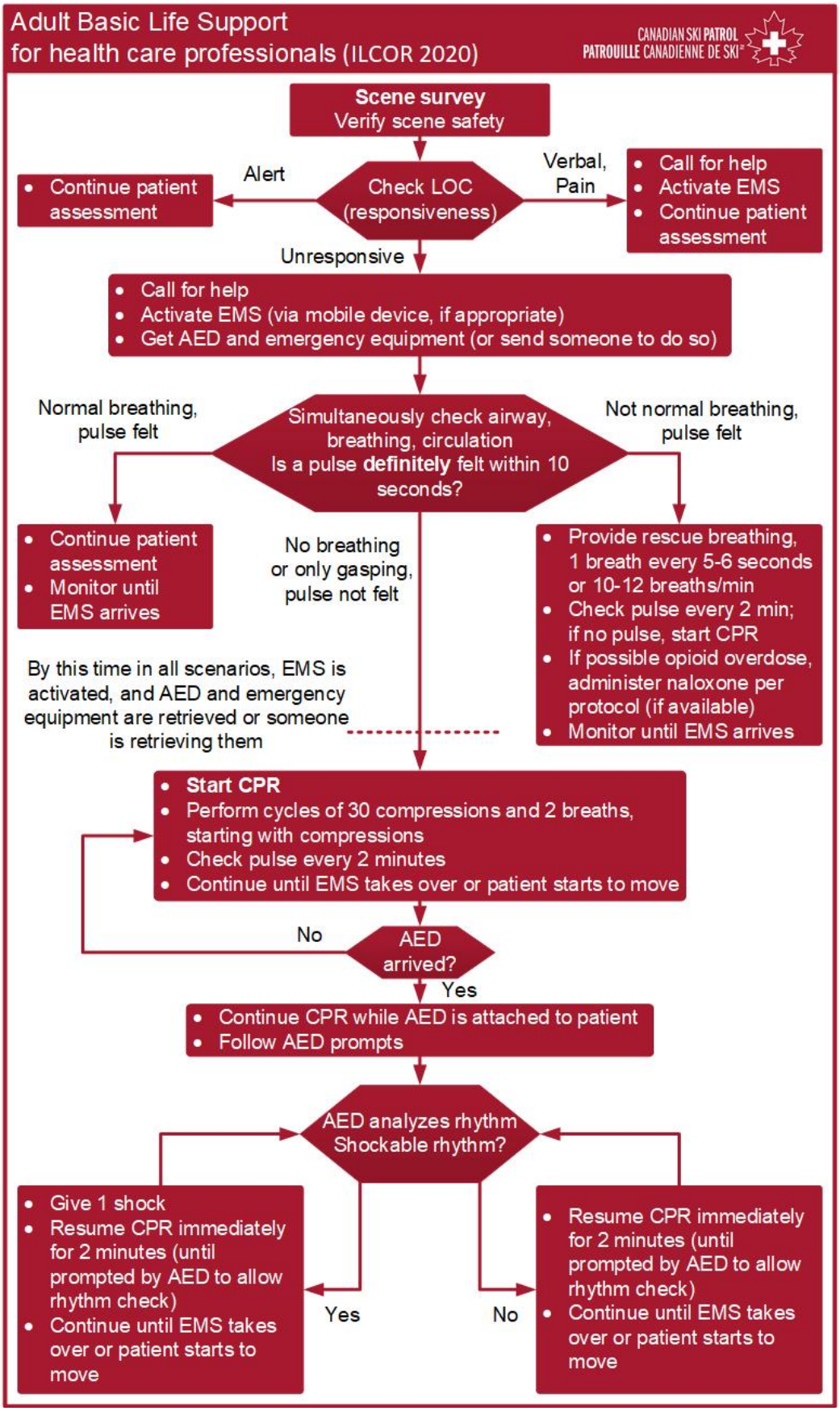
Adult Basic Life Support
for health care professionals (ILCOR 2020)
CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI
Scene survey
Verify scene safety
Check LOC (responsiveness)
Alert
Continue patient assessment
Verbal, Pain
Call for help
Activate EMS
Continue patient assessment
Unresponsive
Call for help
Activate EMS (via mobile device, if appropriate)
Get AED and emergency equipment (or send someone to do so)
Simultaneously check airway, breathing, circulation
Is a pulse definitely felt within 10 seconds?
Normal breathing, pulse felt
Not normal breathing, pulse felt
Continue patient assessment
Monitor until EMS arrives
No breathing or only gasping, pulse not felt
Provide rescue breathing, 1 breath every 5-6 seconds or 10-12 breaths/min
Check pulse every 2 min; if no pulse, start CPR
If possible opioid overdose, administer naloxone per protocol (if available)
Monitor until EMS arrives
By this time in all scenarios, EMS is activated, and AED and emergency equipment are retrieved or someone is retrieving them
Start CPR
Perform cycles of 30 compressions and 2 breaths, starting with compressions
Check pulse every 2 minutes
Continue until EMS takes over or patient starts to move
AED arrived?
No
Yes
Continue CPR while AED is attached to patient
Follow AED prompts
AED analyzes rhythm
Shockable rhythm?
Give 1 shock
Resume CPR immediately for 2 minutes (until prompted by AED to allow rhythm check)
Continue until EMS takes over or patient starts to move
Yes
No
Resume CPR immediately for 2 minutes (until prompted by AED to allow rhythm check)
Continue until EMS takes over or patient starts to move

Figure 6-19: Adult BLS algorithm.

Spontaneous breathing

If spontaneous breathing returns when opening an airway or using any of the described ventilation techniques:

1. Establish and maintain an open airway.
2. Re-assess and stabilize all priorities and then perform a physical examination.
3. Monitor the patient's breathing after two minutes and every five minutes thereafter.
4. Place the patient in the semi-prone recovery position if there are no spinal or other concerns.

Cardiopulmonary resuscitation (CPR)

CPR is a proven technique to administer basic life support to a patient whose heart has stopped beating. CPR consists of chest compressions and rescue breaths.The heart is located in the centre of the chest between the sternum and the spine. Chest compressions squeeze the heart between these two structures, causing blood to be pumped through the body. Rescue breaths provide oxygen to the lungs to oxygenate the blood.

Keep in mind that perfectly performed CPR will give, at most, 20 to 30 per cent of the normal body's arterial blood flow. This is the minimum required for sustaining life.

Patrollers who are trained, able and willing to give rescue breaths and chest compressions should do so for all unresponsive adults, children and infants with abnormal breathing.

In the absence of an adequate barrier device patrollers may be unwilling to perform rescue breathing on a patient. In this case, patrollers should at least perform the chest compression sequences (compression-only CPR). Rescue breathing may also not be possible if there is severe trauma to the face.

Pulse check

For an adult or child, the most dependable site to take a pulse is the carotid artery. It is usually quite accessible, very large and close to the heart. For an infant the most dependable site is at the brachial artery.

A pulse check on the carotid artery is performed as follows:

- Place two or three fingers on the anterior midline of the patient’s neck.
- The pulse can be felt by sliding your fingers back along the side of the neck until they slide into the soft area between the front of the neck and the large muscle at the side of the neck.

Figure 6-20: Carotid artery pulse check

For an infant, a pulse check on the brachial artery is performed as follows:

- Place two or three fingers along the humerus, between the biceps and triceps muscles on the inside (medial side) of the arm.

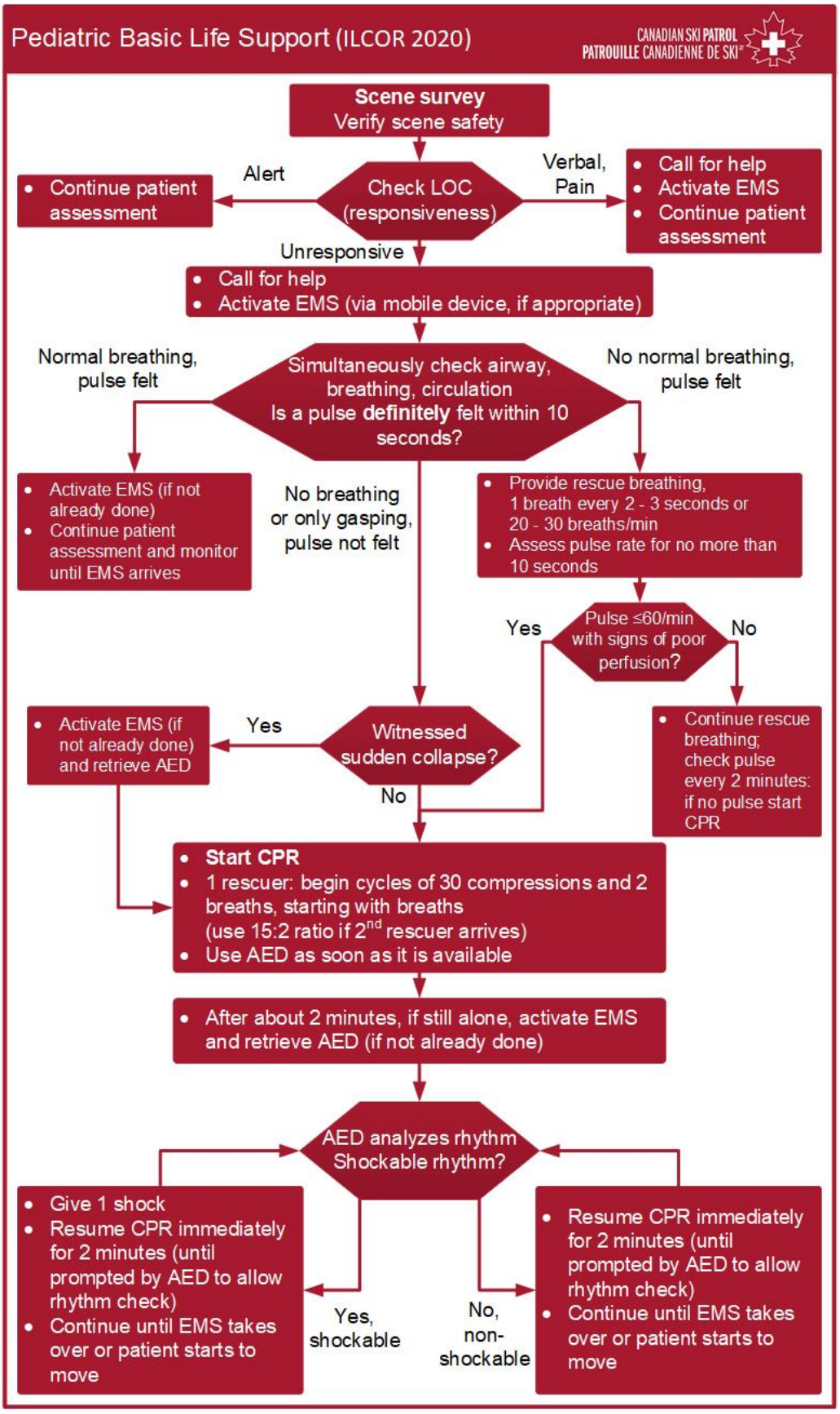
Pediatric Basic Life Support (ILCOR 2020)
CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI
Scene survey
Verify scene safety
Check LOC (responsiveness)
Alert
Continue patient assessment
Verbal, Pain
Call for help
Activate EMS
Continue patient assessment
Unresponsive
Call for help
Activate EMS (via mobile device, if appropriate)
Simultaneously check airway, breathing, circulation
Is a pulse definitely felt within 10 seconds?
Normal breathing, pulse felt
No normal breathing, pulse felt
Activate EMS (if not already done)
Continue patient assessment and monitor until EMS arrives
No breathing or only gasping, pulse not felt
Provide rescue breathing, 1 breath every 2 - 3 seconds or 20 - 30 breaths/min
Assess pulse rate for no more than 10 seconds
Pulse ≤60/min with signs of poor perfusion?
Yes
No
Witnessed sudden collapse?
Yes
Activate EMS (if not already done) and retrieve AED
No
Continue rescue breathing; check pulse every 2 minutes: if no pulse start CPR
Start CPR
1 rescuer: begin cycles of 30 compressions and 2 breaths, starting with breaths (use 15:2 ratio if 2nd rescuer arrives)
Use AED as soon as it is available
After about 2 minutes, if still alone, activate EMS and retrieve AED (if not already done)
AED analyzes rhythm
Shockable rhythm?
Give 1 shock
Resume CPR immediately for 2 minutes (until prompted by AED to allow rhythm check)
Continue until EMS takes over or patient starts to move
Yes, shockable
No, non-shockable
Resume CPR immediately for 2 minutes (until prompted by AED to allow rhythm check)
Continue until EMS takes over or patient starts to move

Figure 6-21: Pediatric BLS algorithm.

Never practice CPR on a patient who has a detectable pulse or other signs of circulation. Use the proper practice equipment and mannequins when reviewing the procedure.

Adult CPR

The algorithm for performing CPR on an adult is shown in the Figure 6-20.

Check for the pulse at the carotid artery. Palpation of the pulse as the sole indicator of the presence or absence of cardiac arrest is unreliable.

If an adult person is unresponsive with abnormal or absent breathing and no definite pulse is found within 10 seconds, it is reasonable to assume that the person is in cardiac arrest. CPR should begin immediately.

If in doubt whether a person is experiencing cardiac arrest or not, the patroller should start CPR without concern of causing further harm.

Landmarking for an adult patient

- To achieve more effective compressions, it is recommended that the dominant hand should be placed against the sternum with the non-dominant hand over the first.
- Place the heel of the dominant hand on the sternum in the centre of the chest. Make sure that the heel of the hand doesn't land on the xiphoid process (the lower end of the sternum). Place the heel of the non-dominant hand on top of the first hand. Interlace the fingers, to keep them off the chest. Only the heel of the bottom hand should be in contact with the chest.
- Remember it is very important to landmark every time you remove your hands from an adult patient's chest and are about to give compressions. Correct landmarking will help minimize the danger of injury and improve blood flow to the body. Incorrect positioning could result in separated or fractured ribs.
- CPR must be performed on a hard, flat surface like a floor or backboard.
- While performing compressions, keep the arms straight with the elbow locked and shoulders directly over the patient’s sternum.

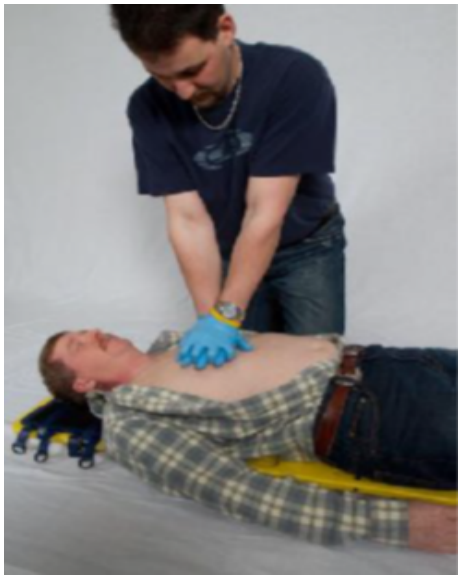

Figure 6-22: Chest compressions on an adult

CPR cycle for an adult patient

- CPR for an adult should start with chest compressions rather than rescue breaths.
- Chest compressions for an adult patient should be performed at a rate of 100 to 120 per minute with the intent to administer 30 compressions in 15 to 18 seconds.
- Chest compressions for an adult patient must be done to a depth of approximately five cm; a compression depth of more than six cm should be avoided.
- Avoid leaning on the chest between compressions to allow full chest-wall recoil.
- A ratio of 30 compressions to two rescue breaths (30:2) should be used.
- Interrupting chest compressions to deliver two rescue breaths should take less than 10 seconds.
- Check for pulse every five cycles or two minutes for no more than 10 seconds.
- Use the AED as soon as it is available.
- Continue to perform CPR while the AED is set up and pause only when it is ready for analysis and, if indicated, provides a shock.
- In any setting, resume chest compressions immediately after shock delivery for adults who are unresponsive with abnormal breathing. Total pre-shock and post-shock pausing between compressions should be as short as possible.
- If an AED is not available, continue performing CPR until EMS arrives.

Two-patroller CPR

If a second patroller arrives while one-patroller CPR is in progress do the following:

- Second patroller arrives and identifies themselves as a person trained in two-patroller CPR and offers their help (e.g., I know CPR. May I help you?).
- After the first patroller has acknowledged the second, the second patroller asks if EMS has been activated:
  - If EMS has not been activated then the second patroller activates EMS and returns to the scene, bringing the AED if available.
  - If EMS has been activated, then the patroller waits for directions from the first patroller.

If the first patroller has been performing CPR for more than two minutes, the newly arrived patroller should take over the compressions. It is recommended that both patrollers switch positions every two minutes as this will provide effective CPR without getting too tired.

Figure 6-23: Two-patroller rescue breathing and chest compressions.

Changeover sequence

1. The patroller at the chest does two minutes of compressions while the patroller at the head provides the breaths.
2. Patrollers switch positions. The patroller at the head goes to the chest and the patroller at the chest goes to the head.

3. The patroller at the head checks the patient's breathing. If no breathing, tells the patroller at chest to begin compressions.
4. Patrollers then switch positions again after two minutes.

Efficiency check

The patroller at the head should frequently assess the effectiveness of chest compressions by taking the pulse while the other patroller is performing chest compressions. If there is no pulse, advise the patroller doing compressions and ask them to push deeper and allow full recoil.

Pediatric CPR

The algorithm for performing CPR on a child or infant is shown in Figure 6-23.

For unresponsive children and infants, look for no breathing or only gasping and simultaneously check for pulse.

If the patient's pulse is definitely felt within 10 seconds with abnormal breathing, begin rescue breathing. If the pulse rate is less than or equal to 60 per minute, add compressions. Check the pulse every two minutes. If no pulse is found, begin CPR.

For children and infants who are unresponsive with no breathing or only gasping and no pulse, begin CPR starting with breaths.

Landmarking for a child patient

Chest compressions on children may be performed with one or two hands.

- If using two hands, place the heel of the dominant hand on the sternum in the centre of the chest. Make sure that the heel of the hand doesn't land on the xiphoid process (the lower end of the sternum). Place the heel of the non-dominant hand on top of the first hand. Interlace the fingers to keep them off the chest. Only the heel of the bottom hand should be in contact with the chest.

Figure 6-24: Landmarking for one-hand chest compressions for a child.

- If using one hand, place the heel of that hand on the sternum, in the centre of the chest. Make sure that the heel of the hand doesn't land on the xiphoid process located at the bottom of the sternum. Only the heel of the hand should be in contact with the chest.
- Observe and remember the hand position. On a child, subsequent landmarking is done visually.

CPR cycle for a child:

- Two rescue breaths should be given before chest compressions.
- Chest compressions should be performed at a rate of 100 to 120 per minute.
- Chest compressions should be one-third of the depth of the chest, approximately 5 cm but not more than 6 cm.
- Patrollers should avoid leaning on the chest between compressions to allow full chest-wall recoil.
- For one-patroller CPR, a ratio of 30 compressions to two rescue breaths (30:2) should be used.
- For two-patroller CPR, a ratio of 15 compressions to two rescue breaths (15:2) should be used.
- Check for pulse every five cycles or two minutes for no more than 10 seconds.
- Use the AED as soon as it is available.

Landmarking for an infant patient

Chest compressions on infants can be performed with the two-thumb encircling technique or with the two-finger technique. For newborns, the two-thumb encircling technique is preferred.

For the two-finger technique:

- Place two fingers in the middle of the infant's chest between the nipples.
- Slide the fingers to just below the nipple line.

Figure 6-25: Landmarking and chest compressions on an infant. a. two-thumb encircling, b. two-finger.

CPR cycle for an infant:

- Two rescue breaths should be given before chest compressions.
- Chest compressions should be performed at a rate of 100 to 120 per minute.

- Chest compressions should beat least one-third of the depth of the chest, approximately 4cm.
- Allow full chest-wall recoil between compressions.
- For one-patroller CPR, a ratio of 30 compressions to two rescue breaths (30:2) should be used.
- For two-patroller CPR, a ratio of 15 compressions to two rescue breaths (15:2) should be used.

CPR during a declared epidemic or pandemic

Performing CPR while using a BVM for artificial respiration are aerosol-generating procedures. In a medical setting, these procedures require the use of properly sized and fitted N95 masks, face shields and isolation gowns.

As the CSP does not recommend the use of N95 masks by patrollers, use chest compressions only, when performing one-patroller or two-patroller CPR in conjunction with an AED when available. Cover the patient's nose and mouth with a surgical mask that is secured in place using the ear loops and ensure that an open airway is maintained using the techniques described in opening the airway. An OPA can be inserted if you are wearing a surgical mask and a face shield or eye protection. Oxygen may be delivered using a standard non-rebreather mask that is held in place and covered with an unfolded triangular bandage.

Considerations for resuscitation in the patrolling environment **For information only**

Cardiac arrest management strategies in a patrolling environment

Cardiac arrest can occur due to a primary cardiac event, trauma or burial. Cardiac arrest survival is time dependent. Therefore, management strategies need to be thought out in advance of the event. These strategies can be applied in any patrolling environment.

Strategies for cardiac arrest management are:

1. Resuscitate in place until return of spontaneous circulation, then transport.
2. Perform cardiac compressions during transport.
3. Set up stations to resume resuscitation between periods of transport without CPR.
4. Load and Go. Transport the patient to the patrol room as fast as possible, without CPR during transport.

Regardless of which strategy is used, the patrol room and patrol personnel must be ready to resume/take over resuscitation prior to the arrival of the patient to the patrol room. Ensure that access to the patrol room is clear and that any equipment is ready to be used.

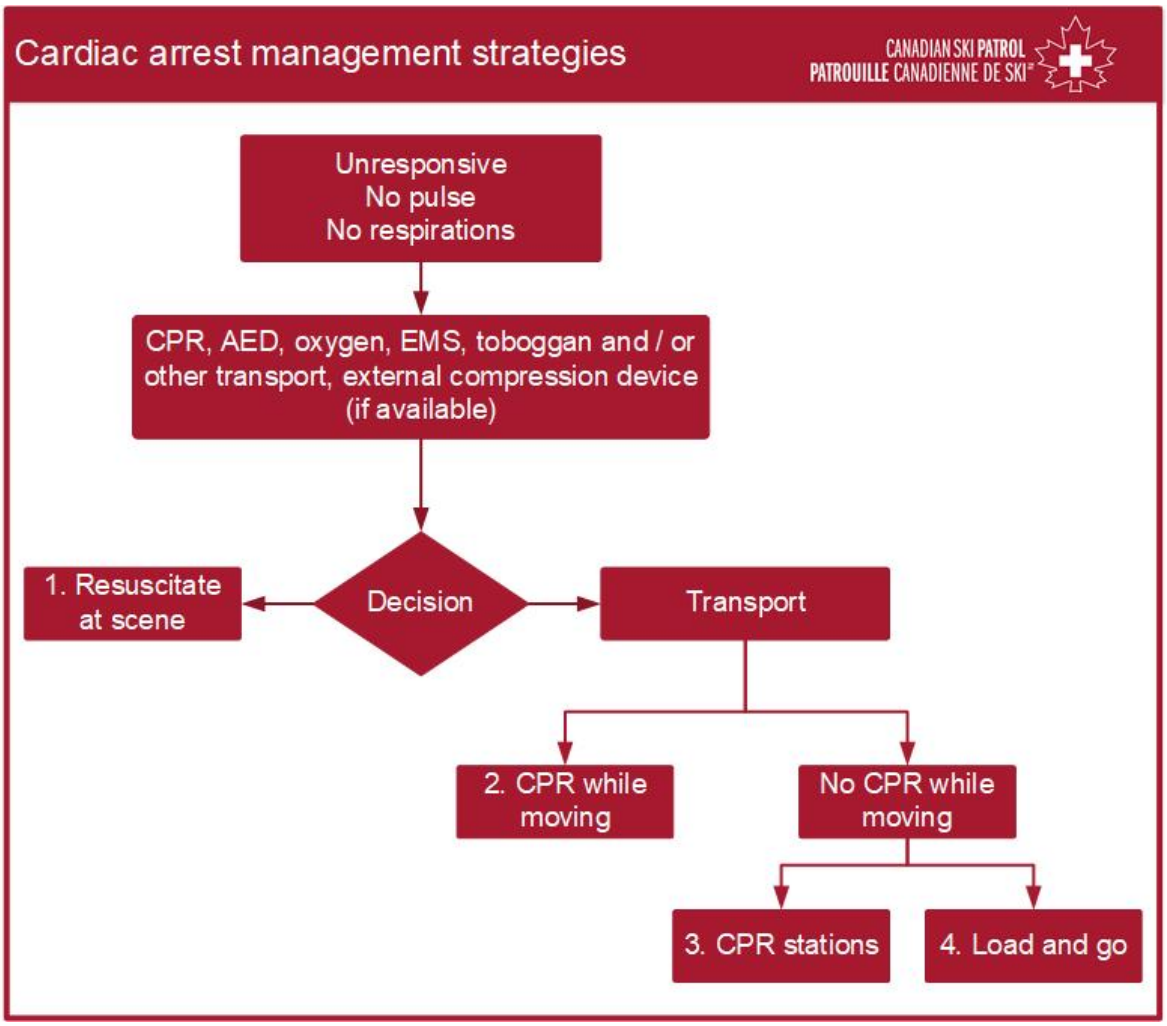

Figure 6-26: CPR strategies algorithm

Strategy	Description	Considerations
1	Resuscitate in place until return of spontaneous circulation, then transport	Focused, specific communication as early as possible is critical as the arrival of equipment and assistance takes time. Request an AED, trauma pack, EMS and any other resuscitation equipment that may be at the area. Removal of clothing from the patient's chest is required regardless of weather or temperature. High quality CPR, early defibrillation and resuscitating in place has the highest likelihood of cardiac arrest survival.
NOTE: There is no empirical (research-based) evidence that any one transport strategy described below is superior to the others. Each has anecdotal or expert opinion to support its use. The strategy decision is based on a number of factors including: • patient's condition, size and weight • location of the incident and proximity to an AED • terrain • weather • distance to the patrol room and EMS In some incidents, all three strategies may be applied during the resuscitation effort. Use of a tail rope may also be appropriate given patient size, terrain and/or area practises.		
2	Perform cardiac compressions during transport	Research[1] has demonstrated that effective chest compressions can be delivered in a moving toboggan if the patient is loaded with their head to the back of the toboggan and the compressor faces backwards, straddling the patient's hips. This position is also used when being pulled by a snowmobile[2]. No attempts to ventilate the patient should be made during transport. Ventilation and oxygenation occur passively as a result of chest compressions. Supplemental oxygen by mask or nasal cannula can be provided during transport.
3	Set up stations to resume resuscitation between periods of transport without CPR	Setting up resuscitation stations spaced at regular transport time intervals, will allow movement of the patient combined with resumption of resuscitation efforts. A minimum of two minutes of CPR should precede each transport phase. Transport must begin immediately after the last compression is delivered and ends at the next station when compressions are resumed. A transport time of less than 60 seconds* between stations including braking to a halt and exposing the patient's chest, is a rough guide of distance between stations but is based on opinion. This strategy requires the most team coordination and practice to become efficient.
4	Load and Go. Transport the patient to the patrol room as fast as possible, without CPR during transport	Making the decision to cease resuscitation efforts and "run for the patrol room" may be applicable for small ski areas with EMS personnel just minutes away, such as ski hills very close to or within urban centres. The length of transport time with the best survival rate has not been determined but generally "shorter is better". Current CPR standards advocate a maximum of 10 seconds for pauses in chest compressions*.

Figure 6-27: Strategy 2: CPR in a moving toboggan

Respiratory arrest management strategies in a patrolling environment

If the patient is not breathing spontaneously or is breathing extremely slowly and ventilation assistance is required, load the patient in the toboggan with their head towards the front of the toboggan. Leave enough space so that a patroller can ride at the patient's head to provide mouth-to-mask ventilations, with supplementary oxygen.

A length of respiratory extension tubing with a mouthpiece, added to a pocket mask with a one-way valve will allow the patroller to use two hands to seal the face mask against the patient's face, ventilate the patient with good feedback of successful air entry and lower the patroller's centre of gravity while moving. Testing has shown that a length of tubing 36-40 cm long is adequate. Supplemental oxygen can be added to the pocket mask or administered to the patroller by nasal cannula to increase the oxygen content of the expired air going to the patient. The use of this Tube-Valve-Mask has been demonstrated to be superior to the use of the Bag-Valve-Mask when moving[3,4].

Figure 6-28: Tube-Valve-Facemask.

References

1. Abrams T. and Torfason L. (2020) Evaluation of the Quality of Manual Compression-Only Cardio-Pulmonary Resuscitation in a Moving Ski Patrol Toboggan. High Altitude Medicine & Biology, Jan 2020, 21(1):1-9. http://doi.org/10.1089/ham.2019.0047.
2. Thomassen O, Skaiaa SC, Assmuss J, et al. Mountain rescue cardiopulmonary resuscitation: a comparison between manual and mechanical chest compressions during manikin cardio-resuscitation. Emerg Med J 2017; 34(9):573-577.
3. Giffen PR Jr, Hope CE: Preliminary evaluation of a prototype tube-valve-mask ventilator for emergency artificial ventilation. Ann Emerg Med, Mar 1991, 20(3):262-266
4. Abrams T. Patient ventilation in a moving toboggan: Mouth-Extension Tube-Mask versus Bag-Valve-Mask. Apr 1997. Presented to Medical Advisory Committee of Canadian Ski Patrol.

Drowning

Drowning occurs when someone is unable to breathe because their nose and mouth are submerged in water or in another liquid. When someone is drowning, they will not be able to make a noise, so they can easily go unnoticed, even if others are nearby. Cardiac arrest in near-drowning victims is caused by lack of oxygen and physical changes in the blood. In common with other respiratory-based causes, the body's systems will shut down due to the lack of oxygen and can easily result in the rapid onset of brain damage. CPR may still be effective even if a near-drowning victim has been submerged for a long period, especially in cases where the water is cold.

As soon as the patient has been rescued from the water, open the airway and check for spontaneous breathing and the presence of a pulse. If the patient is unresponsive and is not breathing, activate EMS and provide two initial rescue breaths before starting CPR chest compressions.

Patients of near drowning who receive chest compressions are likely to vomit. Patrollers should turn the patient on their side and clear the airway with fingers or suction.

If the patient starts breathing again at any time, treat them for hypothermia by covering them with warm clothes and blankets. If they recover completely, replace their wet clothes with dry ones. Monitor respirations, pulse and LOC until help arrives.

Points to remember

- EMS activation. If the patient is suffering from respiratory arrest (or drowning) and you are alone, perform five cycles of CPR before calling/activating EMS.
- Maintain the correct body and hand position for most effective CPR and to prevent further injury to the patient.
- CPR should never be interrupted for more than 10 seconds to:
  - Transport a patient down/up stairs.
  - Move a patient from further danger.
- Always release pressure from the chest between compressions to allow the heart to fully refill. Maintain contact with the skin at all times. Do not lean on the patient's chest.
- Deliver each breath over one second, each causing the chest to rise.
- For an adult or child, interlace fingers of both hands or extend them straight out to give a straight, downward pressure on the sternum and not on the ribs.
- Expect some damage to the patient's chest while doing CPR. Ribs may fracture, or separate from the sternum during the procedure. Correct hand position should help to prevent further internal damage.
- Injuries to the chest area can be life-threatening if they result in damage to either the heart or lungs, or cause severe internal bleeding. Fractures of the rib cage may result in serious injury to the vital organs. However, it is possible to apply CPR even if chest injuries are present.
- Patrollers may require critical incident stress (CIS) support after performing CPR.

Do not resuscitate (DNR)

Do not resuscitate cases where the patient is:

- decapitated
- in rigor mortis
- incinerated
- eviscerated
- decayed
- prolonged submersion, i.e.,days of decomposition
- ordered not to by a physician

Major trauma with absent vital signs and fixed pupils may include the following:

- open or crushed head injury
- crushed or penetrating chest injury

In a situation with multiple trauma patients, patients with life-threatening injuries and vital signs present are given priority treatment over patients who do not have any vital signs present.

Figure 6-29: The Canadian Chain of Survival.

Chain of survival

The Canadian Ski Patrol recommends emphasis on the early recognition, early EMS, early CPR, early defibrillation and early advanced care links.

Recognition of warning signs

- Not all heart diseases and strokes can be prevented. The symptoms of heart attack and stroke must be recognized early enough, so that proper help can be obtained.
- Common delays to treatment include: denial, lack of recognition of symptoms, and not knowing what action to take.

Early access to the emergency medical services (EMS) system

- Once bystanders recognize the emergency, the EMS system must be activated by calling 911 or the local emergency number.
- Individuals experiencing the signs or symptoms of a heart attack or stroke must be assisted as quickly as possible to prevent death and disability.

Early CPR

- To increase survival chances, basic CPR must be started immediately after cardiac arrest is recognized.
- CPR keeps oxygenated blood flowing to the heart and the brain until normal circulation can be restored.

Early defibrillation

- Defibrillation, which re-establishes a normal spontaneous rhythm in the heart, is the link most likely to improve survival rates in heart attack patients.
- The speed with which defibrillation is performed is a major determinant of the success of the resuscitation attempt.

Early advanced care

- Advanced care may be provided at the scene and/or at the hospital by trained health care professionals.

7. Automated external defibrillator (AED)

Learning outcome:

Describe, understand, and demonstrate the use of AEDs.

The CSP requires new candidates to successfully complete a CPR BLS/AED evaluation as part of the AFA qualification process. Returning patrollers are required to successfully complete a CPR BLS/AED re-qualification session, including written exam, on an annual basis. A CPR BLS/AED qualification card may be issued upon completion.

Upon completion of this chapter you should be able to:

1. Explain how an automated external defibrillator (AED) works.
2. Demonstrate the operation of an AED.
3. Describe the use of an AED for various types of injured persons in different environments.
4. Explain the information to be given to EMS personnel.

In this chapter:

Introduction 121
What is an AED and how does it work? 121
- Conduction system of the heart 121
- Ventricular fibrillation (VF) 122
- Ventricular tachycardia 123
- Asystole 123
- Pulseless electrical activity (PEA) 123

How to use an AED 123
- Pad placement 125
- Special considerations 125
- Troubleshooting and maintenance 127
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- Handover to EMS 128

Introduction

The Canadian Ski Patrol recognizes the importance of early defibrillation and promotes public access to defibrillation so that all cardiac arrest patients can have access to defibrillation within the first five minutes of cardiac arrest. Access to an AED is of the utmost importance to a patient that has no pulse. Be aware of AED signage or icons and where to find one in your local context. An AED can be used by anyone, even someone who has never used one before, by following the AED's voice prompts. When cardiac arrest is assessed, ask another patroller, or a bystander, to bring an AED, if available, when activating EMS, or if you are alone get one yourself.

What is an AED and how does it work?

When someone suffers sudden cardiac arrest, such as a myocardial infarction (MI) or heart attack, or an arrhythmia this can send the heart into an abnormal electrical rhythm.An AED is a computerized electronic device that applies an electrical shock to the heart to stop all electrical activity or rhythm. This shock over rides the abnormal rhythm, allowing the heart to restart in a normal rhythm.

The AED is used when a patient is not breathing and has no pulse. Once attached to the patient, the AED will evaluate the electrical rhythm and indicate to the patroller if a shock is needed. If no shock is indicated, the patroller will continue with CPR.

Figure 7-1: Examples of an AED (Lifepak and Phillips)

Conduction system of the heart

The heart is a muscle that relies on large volumes of oxygenated blood to keep pumping blood throughout the body. There are specialized cells in the heart that generate electrical impulses. The electrical impulses originate from the sinoatrial (SA) node located in the right atrium which is considered the natural pacemaker of the heart. In normal circumstances, these electrical impulses are coordinated; they cause the heart muscle to contract and relax, allowing the heart to pump blood.

From the SA node, the impulses travel to the atrioventricular (AV) node located near the middle of the heart and then travel around the ventricles, causing them to contract.

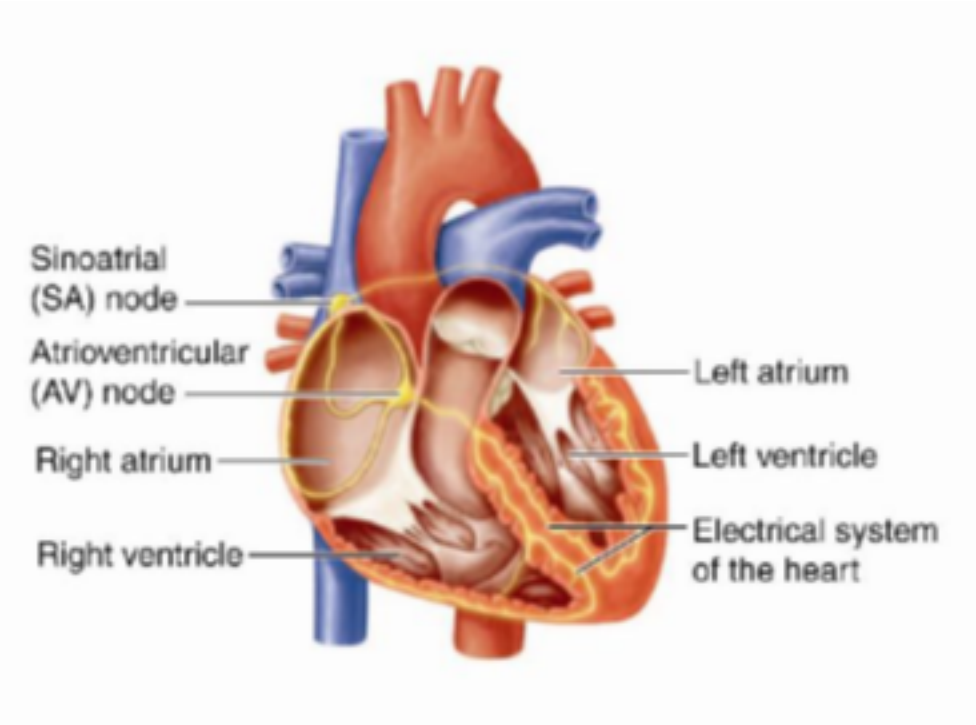

Figure 7-2: Sinoatrial and atrioventricular nodes

During a heart attack, the tissue in the area where the attack happens dies, preventing the electrical impulses from traveling across the dead tissue area. When this happens the electrical impulses are disrupted and are no longer coordinated resulting in abnormal heart rhythms.

There are many types of irregular heart rhythms that can be caused by a heart attack. Most cardiac arrest patients (85 per cent) go into ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT). The AED will deliver an electrical shock to try to correct these abnormal rhythms.

Figure 7-3:Normal sinus rhythm

Ventricular fibrillation (VF)

When the heart goes into VF, the electrical impulses within the heart become uncoordinated.The impulses originate from many areas of the ventricles and are out of synch with each other.This causes the heart to quiver and prevents the ventricle from effectively pumping blood. The use of an AED will diagnose VF and indicate a shock is required.

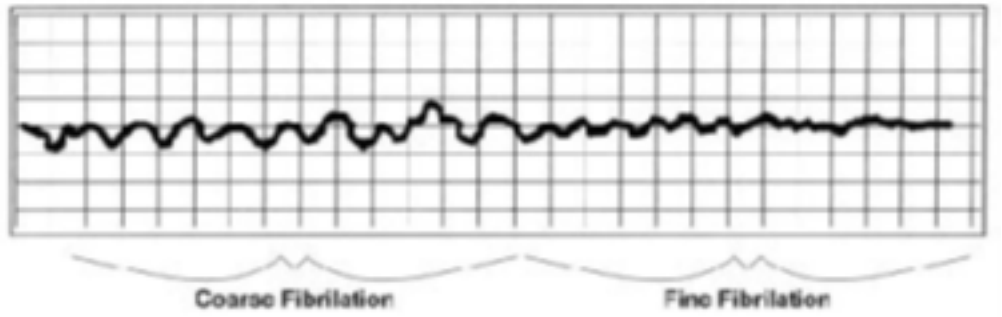

Figure 7-4: Ventricular fibrillation

Ventricular tachycardia

When the heart goes into VT, the electrical impulses become very fast. The impulses are so fast (more than 180 per minute) that the ventricles do not have time to fill and pump blood.The use of an AED will diagnose VT and indicate a shock is required.

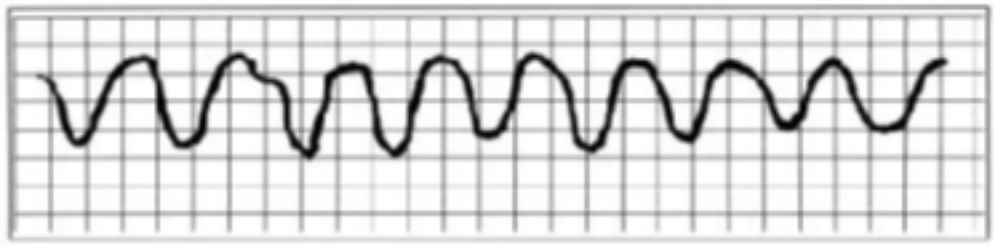

Figure 7-5: Ventricular tachycardia

Asystole

When the heart muscle has no electrical activity, it appears on an electrocardiogram (ECG) monitor as a flat line or asystole. In this case defibrillation is ineffective, and the AED will advise that there is no shock indicated.

Pulseless electrical activity (PEA)

Pulseless electrical activity (PEA) refers to electrical activity present in the heart that should produce pulse but does not. This results from the heart failing to work or pump blood either because of damage to the heart or as a result of major blood loss. The AED will indicate that there is no shock required.

How to use an AED

When the AED arrives at the patient's location, the AED should be turned on and connected to the patient's bare chest. All AEDs, once turned on, will give audio prompts to guide you through the AED sequence. Most AEDs also display instructions that match the voice prompts. Always follow the AED's instructions. Continue CPR until the AED pads have been placed on the patient and the AED indicates that CPR should be paused for analysis.

1. Turn power on.
2. Attach or connect the cables to the AED (some AEDs may have pre-connected cables).

3. Open electrode package.
4. Expose the patient's chest.
5. Fast removal of excessive chest hair can be done before the application of pads, so long as the delay to shock delivery is minimal. Too much hair will interfere with the AED's ability to check the heart rhythm.
6. Dry the patient's chest where the pads are to be attached. If the chest is too wet, it will interfere with the pads adhering to it.
7. Attach the pads to patient's chest after peeling the backing off.
8. Stand clear and do not touch the patient. No one can be in contact with the patient.
9. Some AEDs automatically analyze the results, some require that an analyze button be pushed. If the AED has an Analyze button, push it.

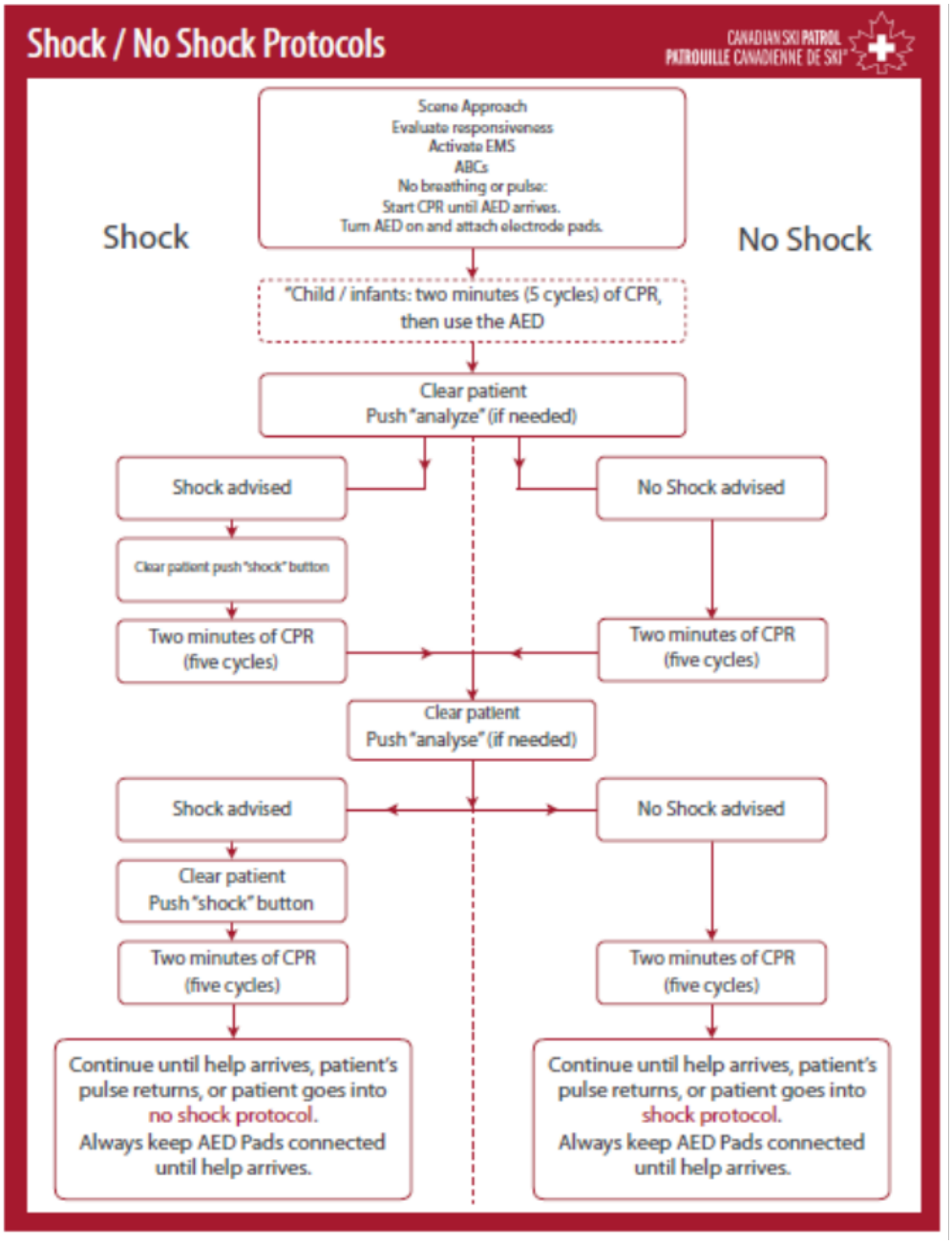
Shock / No Shock Protocols
CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI
Scene Approach
Evaluate responsiveness
Activate EMS
ABCs
No breathing or pulse:
Start CPR until AED arrives.
Turn AED on and attach electrode pads.
Shock
No Shock
"Child / infants: two minutes (5 cycles) of CPR, then use the AED
Clear patient
Push "analyze" (if needed)
Shock advised
No Shock advised
Clear patient push "shock" button
Two minutes of CPR (five cycles)
Two minutes of CPR (five cycles)
Clear patient
Push "analyse" (if needed)
Shock advised
No Shock advised
Clear patient
Push "shock" button
Two minutes of CPR (five cycles)
Two minutes of CPR (five cycles)
Continue until help arrives, patient's pulse returns, or patient goes into no shock protocol.
Always keep AED Pads connected until help arrives.
Continue until help arrives, patient's pulse returns, or patient goes into shock protocol.
Always keep AED Pads connected until help arrives.

Figure 7-6: Shock No-Shock

10. Follow the shock or no shock protocols.
11. If a shock is indicated, push the Shock button after making sure no one is in contact with the patient. (Some protocols require the AED provider to say, "I'm clear, you're clear, everyone clear" before pushing the shock button.)
12. Chest compressions should resume immediately after shock delivery, or if no shock is advised, without delaying for rhythm reanalysis or a pulse check.

Pad placement

When attaching the AED electrode pads to the patient, follow the directions on the pads.Most pads have pictures that show where the pads are to be attached. One pad will be attached to the patient's right upper chest, just below the clavicle. The other pad is attached on the patient's left lower anterior chest wall.

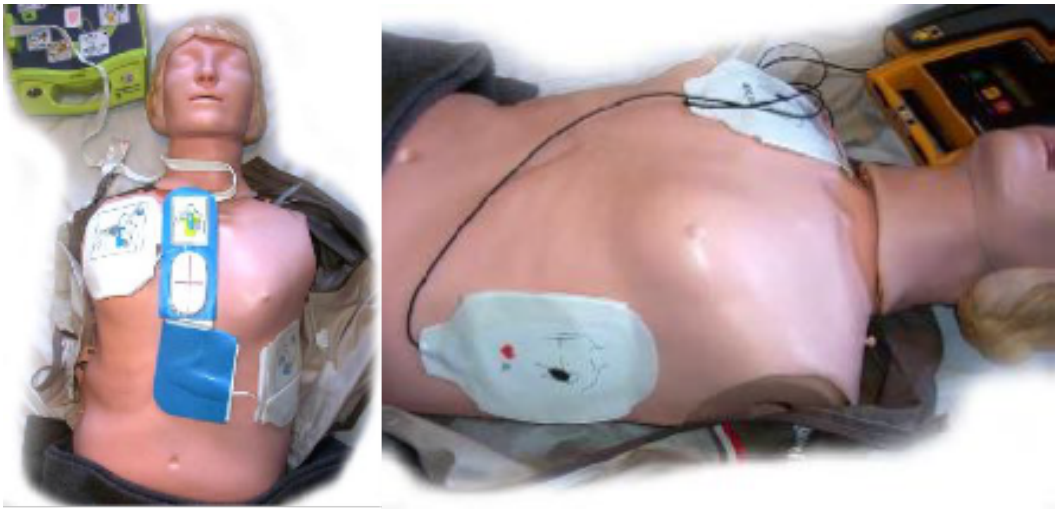

Figure 7-7: Examples of pad placement (Lifepak500, ZOLL AED Plus)

Special considerations

Hypothermic patient

In cases of hypothermia, follow the AED prompts and continue with CPR and handle the patient gently.

Water and wet environments

The AED should never be used in wet environments. The patient must be removed from the water (shower or pool area, rain) and dried off before using the AED. Do not use if the patient is in large puddles of water. The AED can be used if the patient is lying on snow or ice. If a blanket or backboard is readily available, put it under the patient before delivering a shock.

Moving vehicles

The AED should not be used if the patient/ vehicle is moving. If in a vehicle, stretcher or toboggan it must be stopped in order to analyze and shock. The movement of the patient over a bumpy surface may produce electrical artifact that may mimic VT or VF. This can confuse the interpretation of the heart rhythm by the AED.

Aeroplanes and helicopters

AEDs can safely be used on aircraft. It is recommended to let the aircrew know the AED is being used before delivering a shock.

Trauma patient

The AED should not be used on a severe or major trauma patient. Usually the heart has stopped from lack of blood and not a heart attack. However, if you suspect the patient suffered a heart attack prior to the trauma, the AED may be used while waiting for EMS.

Pregnant patient

The AED can be used normally without any special instructions.

Metal surfaces

The AED can be used on metal surfaces (industrial sites/catwalks, etc.). Ideally a blanket or backboard should be placed under the patient if available.

Patch medications

If the patient has a patch medication where a pad would be placed, remove the patch and clean the area. Remember to wear gloves as the medication is absorbed through the skin.

Pacemakers – implanted defibrillators

Some patients may have an implanted pacemaker or defibrillator. They are usually embedded under the skin in the upper chest area under the left clavicle, or in the upper abdomen. These devices are attached directly to the heart. The implanted defibrillator delivers a small shock to the heart if it detects a shockable rhythm. If breathing and pulse are absent, proceed as normal as the implanted device was ineffective.

When you expose the chest area you will see a bump approximately one to two inches in diameter, just under the skin surface where the device is embedded. Should the device be where the AED pad would be attached, move the pad at least one inch away from the device.

Children and infants

Some AEDs have pediatric pads to allow them to be used on infants or children up to eight years old. If pediatric pads are not available, use the adult pads. When using adult pads, place one pad on the front middle of the chest and the other pad on the middle of the back. The pads must not touch each other.

Use a standard AED on children eight years or older. Pediatric pads should never be used on an adult.

CPR should begin with chest compressions immediately after delivering an AED shock for children in cardiac arrest.

Oxygen

Move oxygen tanks and delivery devices one arm's length away from the patient during the shock phase.

Radio use

Do not transmit on two-way radios during the analysis phase as some radio transmissions may interfere with the AED.

Troubleshooting and maintenance

AEDs are quite reliable devices; there are very few things that can go wrong with them and some faults can be corrected when the AED is turned on. The reason being most AEDs perform a self-check as soon as they are turned on. AEDs can be programmed to perform a self-check at regular intervals; daily, weekly or monthly.

The following are issues that can arise when using an AED:

AED Troubleshooting

Symptom	Problem	Solution
Prompt to connect or attach the electrode pads	Pads are not correctly connected to the AED	1. Ensure the pads are correctly attached to the AED connector. 2. If the prompt continues to display, replace the pads with a new set. (Always ensure that pads have not expired) 3. If the above fail, take the AED out of service.
Warning of a low battery	Low battery charge	An AED with a low battery warning may still have enough power for several shocks. Continue to use the AED until the unit fails. If a spare battery is available, change the battery. Follow manufacturer's directions. Ask for another AED if the unit fails.

Storage

AEDs should not be stored where the electrode pads may freeze. If the pads freeze, they will need to be replaced and cannot be used. Follow the manufacturer's directions for cleaning and servicing.

AED check

The AED must be checked regularly. Follow local procedures and protocols (or manufacturer's directions if more stringent). Most AEDs come with accessory packs. At a minimum, they should have gloves, scissors, razor, towel and a barrier device. Ideally there should be a second set of electrode pads. This accessory pack should be checked regularly.

Legal aspects

Public access to AEDs is now widely available throughout Canada in community settings such as airport terminals, shopping malls, recreation facilities, office buildings and other public locations. Research shows that AEDs are most effectively used by trained individuals. However, AEDs are safe and easy to use by anyone able to follow the text and graphic instructions and voice prompts provided by the AED. Legislation in provinces and territories across Canada protects individuals from liability when an AED is used in the context of saving a life.

Information about individual provincial and territorial regulations on the use of AEDs can be obtained from the provincial and territorial Heart and Stroke Foundation offices.

All medical devices imported into and sold in Canada, including AEDs, are regulated and problems with any products are monitored. Any problems that are found with an AED should be reported to the Public Health Agency of Canada. The Government of Canada works with manufacturers to fix problems that have been identified.

Handover to EMS

Under ideal conditions, a medical report should be sent with the patient to the hospital. Sometimes, patrollers are so busy with patient care that there is very little time to complete a medical report.

At a minimum, paramedics will need to know the following information:

- when the patient was last seen before collapse
- witnesses that saw the patient collapse
- how long CPR was performed
- number of shocks delivered
- patroller's name & contact information

Most AEDs have internal event recorders that will record the following:

- the time as to when the unit was turned on, when shocks were delivered and when the unit was turned off
- presenting cardiac rhythm and post-shock rhythm
- any trouble or fault prompts displayed during the use of the AED

This information can be printed in a report form from the AED internal memory by connecting the unit to a computer or printer.

Some EMS services may want to take the AED with them to download this information. Some AED models come with a removable memory card that can be sent to the hospital with the patient. As soon as possible after the event, the patroller should complete a medical report with as much detail as possible.

A designated person responsible for the AED's at your location could download the information and pass this information together with the above-mentioned report to the receiving hospital. Follow local procedures and protocols. Patrollers may require critical incident stress (CIS) support after performing CPR.

8. Chest injuries

Learning outcome:

Recognize, understand, and treat chest injuries.

Upon completion of this chapter you should be able to:

1. Describe the general signs of chest injury.
2. Outline the signs, symptoms and demonstrate specific treatments for the conditions discussed in this chapter.

In this chapter:

Chest Injuries 130
General signs of chest injuries 130
Subcutaneous emphysema 130
Closed chest injuries 130
Rib fractures 130
Flail chest 131
Use of dressings on a flail chest 132
Pneumothorax 132
Tension pneumothorax 133
Spontaneous pneumothorax 133
Open chest injuries 133
Transport the patient 134
Impaled objects in the chest 134
Conclusion 134

Chest Injuries

Chest injuries can become life-threatening. When there are also breathing difficulties, treat the situation as a Load and Go. If you suspect the presence of a spinal injury, use extreme care during treatment and transportation. Always consider immobilizing the patient on a backboard.

These injuries may result in damage to either the heart or the lung and can cause severe internal bleeding.

Rib cage fractures may result in serious injury to vital organs.

Deep, open wounds allow air to enter the chest cavity; closed wounds usually involve injury to the ribs and possibly underlying structures.

General signs of chest injuries

Look for the following signs beyond an obvious chest wound:

- impaired breathing
- irregular, or lack of, chest expansion
- coughing-up of blood
- shock
- subcutaneous emphysema

Of all the signs, a change in the normal breathing pattern is most indicative of a chest injury.

A patient who has breathing difficulty will usually move into a position where breathing is easiest. Typically, this position will be either sitting or reclining.

Subcutaneous emphysema

When a lung or part of the bronchi is lacerated, air can escape into the chest cavity. This air can then migrate to the subcutaneous tissues making it feel like puffed rice (Rice Krispies) under the skin. This causes a crackling sensation when the skin is pressed. This is why you looked for it during the patient assessment.

Closed chest injuries

Rib fractures

Rib fractures are almost always the result of trauma (a blow) to the rib cage.

Signs and symptoms

- leaning toward the injured side with a hand over the fracture area in an effort to ease pain and stabilize the chest
- a crackling sensation over the fracture site (subcutaneous emphysema) may be detected if the rib fracture has punctured a lung and air is escaping into the tissues of the chest wall
- unwillingness or inability to take a deep breath
- complaining of local pain and tenderness (patients may be able to direct you right to the location of the fracture)
- pain when moving the rib cage when breathing or coughing

Treatment

1. Administer oxygen, if available.
2. Make the patient as comfortable as possible.

3. Transport the patient quickly and safely to medical aid.

If you suspect rib fractures and the patient is having breathing difficulties, arrange for immediate transport. Activate EMS and treat as a Load and Go.

Transporting the patient

Transport the patient in the position of maximum comfort (sitting or reclining). If reclined, the injured side will usually be preferred down. This may have to be modified in the presence of other injuries.

The semi-prone position elevates the good lung, stabilizes the fracture, and prevents drainage of the blood into the good lung.

A conscious patient will usually adopt a comfortable position in order to relieve breathing difficulties. Respect this position if it does not interfere with transportation.

The position of comfort takes higher priority over any theoretical benefit that may be obtained from a specific positioning.

If you also suspect a spinal injury, stabilize the patient and transport on a backboard.

Flail chest

Several adjacent ribs fractured in more than one place can produce a loose section of the chest wall. The loose section is called a flail section (or flail segment) and the condition is known as a flail chest.

The flail section moves inward when the patient breathes in, and outward when the patient breathes out. This phenomenon is known as paradoxical movement. That is:

- Where the chest normally expands during inspiration, a loosened segment will be drawn in.
- Where the chest normally deflates during expiration, the loosened segment will bulge out.

Initially, paradoxical movement may not be seen because the chest muscles may be strong enough to splint the flail segment. As the injury progresses, the chest muscles tire and the paradoxical movement becomes more apparent. This is especially common in injuries to adults.

A flail chest is a serious injury and is frequently the result of injury to underlying vital organs, such as a crushing injury to the lung or heart.

Signs and symptoms

- shortness of breath
- swelling over the injury site
- shock
- muscle splinting of the injury site
- possible paradoxical movement
- severe pain when inhaling or exhaling

Treatment

1. Administer oxygen as soon as possible.
2. If the patient is experiencing difficulty breathing and particularly if cyanosis (blueness) is present, assist breathing with oxygen and assisted ventilations. (see Artificial respiration (Rescue breathing) in Chapter 6)
3. Help the patient get in a comfortable position and transport them to medical aid. Activate EMS and treat as a Load and Go. Continue to monitor vital signs.

4. Do not apply bulky padding or dressings to the flail segment so long as the patient is splinting the chest wall with the chest muscles or unless there is substantial bleeding.

Use of dressings on a flail chest

In the past, taped-on pads used to be the method for reducing pain from the paradoxical motion of a flail segment. However, the tape reduces the mobility of the chest wall and thus limits the already compromised expansion of the lung. Only consider a taped-on pad as a treatment in the following cases:

- a prolonged time before evacuation and access to medical care is expected
- the chest muscles become fatigued and no longer splint the flail segment

To apply dressings:

- Press the segment inward with your gloved hand to stabilize it.
- Splint in the inward position with a pillow, large bulky dressing, or folded blanket or parka.
- Secure this thoroughly in place with tape.
- Be prepared to help breathing by providing assisted ventilation or artificial respiration.
- Do not hold in place with bandages encircling the chest. This would further impair the patient's breathing effort.

Alternatively, have the patient lie with the segment against a hard surface, such as the base of the toboggan, depending on the position of maximum comfort, and other injuries that may be present.

Pneumothorax

A pneumothorax is a condition that results from air entering the pleural space. The air in the pleural space compresses the lung and prevents normal breathing.

There are two types of pneumothorax:

- tension pneumothorax
- spontaneous pneumothorax

Signs and symptoms of pneumothorax

- reduction of normal respiratory movements on the affected side
- a fall in blood pressure
- weak and rapid pulse
- a sudden sharp chest pain

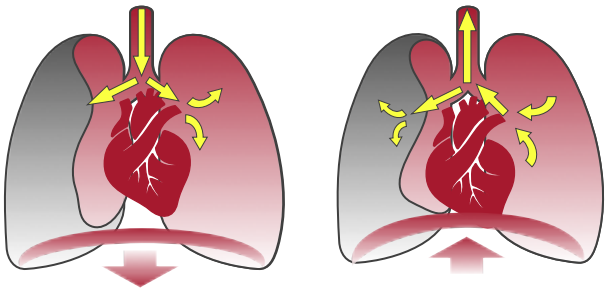

Figure 8-1: Pneumothorax inspiration and expiration.

Tension pneumothorax

Tension pneumothorax is particularly dangerous. It is a condition that occurs when air escapes into the pleural space from damaged lung tissue but cannot regain entry into the lungs with each respiration. As a result, increasing air pressure in the pleural space causes collapse of the lung tissue. As the pneumothorax injured lung collapses, the opposite lung and heart may also be affected.Treatment

1. Administer oxygen, if available.
2. Activate EMS and treat as a Load and Go. Monitor vital signs. As a patroller, you cannot provide surgical release of the air from the chest cavity (see Open chest injuries below).

Spontaneous pneumothorax

Spontaneous pneumothorax is not a life-threatening condition. It occurs when the lung surface - weakened as a result of congenital defect, disease or injury - ruptures.

Treatment

1. Administer oxygen, if available.
2. Transport patient to medical aid.

The patient may prefer to be in a seated position when being transported.

Open chest injuries

In penetration injuries of the chest wall, air can enter the pleural space from the outside, causing the lung to collapse. Air moving back and forth through the chest wall results in what is often called a sucking chest wound because of the sucking sound during inspiration.

Important notes:

If the chest wall is punctured, air can enter the pleural cavity and the patient can develop a pneumothorax. If open chest injuries are not treated properly, they can result in tension pneumothorax.

Signs and symptoms of open chest injuries:

- increasing difficulty in breathing
- frothy blood at the mouth or site of wound
- rapid, weak pulse
- cyanosis
- falling blood pressure
- localized chest pain

Treatment for open chest injuries

Leave chest wounds open. If a dressing and direct pressure are required to control bleeding, care must be taken to ensure that the dressing does not become occlusive and seal the chest wound.

- If there is significant external bleeding, direct pressure to the chest wound with a hand and/or a non-occlusive dressing should be applied.
- If a dressing becomes saturated and the patient is deteriorating, the dressing should be changed to prevent it from sealing the chest wound.

Transport the patient

- Transport in a position of comfort in a position that will not impair breathing.
- Administer oxygen, if available.
- Monitor vital signs.
- Activate EMS and treat as a Load and Go.

Transportation may be done with the head uphill if this is the position of comfort for a person with chest injuries or breathing difficulties for any reason.

Impaled objects in the chest

If the object that caused the open chest wound (knife, ski pole, tree branch, etc.) is still impaled in the chest.

1. Activate EMS and treat as a Load and Go.
2. Do not move or remove the object, since major vessels or organs may have been penetrated. Bleeding into the chest cavity can be massive and may be difficult to detect.
3. Build up a dressing around the object to hold it in place during transportation (see Impaled objects In chapter 12).
4. Transport the patient in the most comfortable position possible, which may be either sitting or lying down.
5. Continue to monitor vital signs.

Conclusion

Chest injuries can become life-threatening. When there are also breathing difficulties, treat the situation as a load and go. If you suspect the presence of a spinal injury, use extreme care during treatment and transportation. Always consider stabilizing the patient on a backboard.

9. Shock and severe bleeding

Learning outcome:

Recognize, understand, and treat shock and severe bleeding.

Upon completion of this chapter you should be able to:

1. Describe the different types of shock.
2. Describe the common signs, symptoms and treatment of shock.
3. Differentiate arterial bleeding, venous bleeding and capillary bleeding.
4. Demonstrate treatment for bleeding injuries.
5. Describe the signs, symptoms and treatment of internal bleeding from various sources.

In this chapter:

Shock 136
- Progressive nature of shock 136
- Signs and symptoms of shock 137
- Treatment for shock 138

Types of shock 139
- Cardiogenic shock 139
- Hypovolemic shock 139
- Bleeding (hemorrhage) (hypovolemia) 139

External bleeding 139
- Arterial bleeding 140
- Venous bleeding 140
- Capillary bleeding 140
- General treatment for external bleeding injuries: 140

Internal bleeding 141
- Internal abdominal bleeding 142
- Internal bleeding at a fracture site 142

Distributive shock 142
- Anaphylactic shock 142
- Septic shock 143

Neurogenic and vagal shock 143
- Neurogenic shock 143
- Vagal shock syncope (fainting) 143
- Obstructive shock 143

Shock

Shock is the medical condition that develops as a result of an imbalance between the delivery of oxygen and the consumption of oxygen at the cellular level. In our everyday lives, the cardiovascular system adjusts to changes in oxygen requirements in various parts of the body and maintains an oxygen equilibrium. These mechanisms of compensation allow blood to be directed to the key organs (heart, lungs, kidneys and brain).

Perfusion is the movement of sufficient oxygenated blood to the cells. Inadequate perfusion, or hypoperfusion, is the result of a problem in one of the three components of the system getting oxygen-rich blood to cells.

Heart

The pump of the system.

Vessels

The pipes of the system.

Blood

The liquid circulating in the system.

A continuous interaction between these three components maintains blood pressure, circulation, perfusion and the delivery of oxygen to the body.

In the patrolling environment, you may see shock as a result of:

- a traumatic event that causes blood loss either internally or externally
- a non-traumatic event, typically due to pump failure or compromise

Sepsis is rarely seen in the field.

Progressive nature of shock

Shock is a progressive condition, with some opportunities for stopping and reversing the progression. However there is a point at which the progression becomes irreversible and death or permanent organ dysfunction results.

The signs of shock will not show equally and will not progress equally in all patients. Some people, such as the elderly or those with pre-existing circulatory conditions, are more vulnerable and will progress more rapidly towards severe complications. Children generally will maintain the appearance of stability and then suddenly crash. At any rate, all patients present a progressive failure in the compensation mechanisms resulting in clinical signs. These signs may be subtle. The primary and secondary assessment system has been designed to detect these signs when combined with repeated measurements of the patient's vital signs. Changes in the vital signs over time and correlating with the history, the signs and symptoms will provide the patroller with a good indication of where the patient is currently in the progression, and whether treatment measures are making a difference.

If the conditions causing the shock are not controlled, death may occur, even if the conditions are not fatal in their own right.

The presence of signs and/or symptoms of shock is the reason to initiate Load and Go. Monitor the patient continuously.

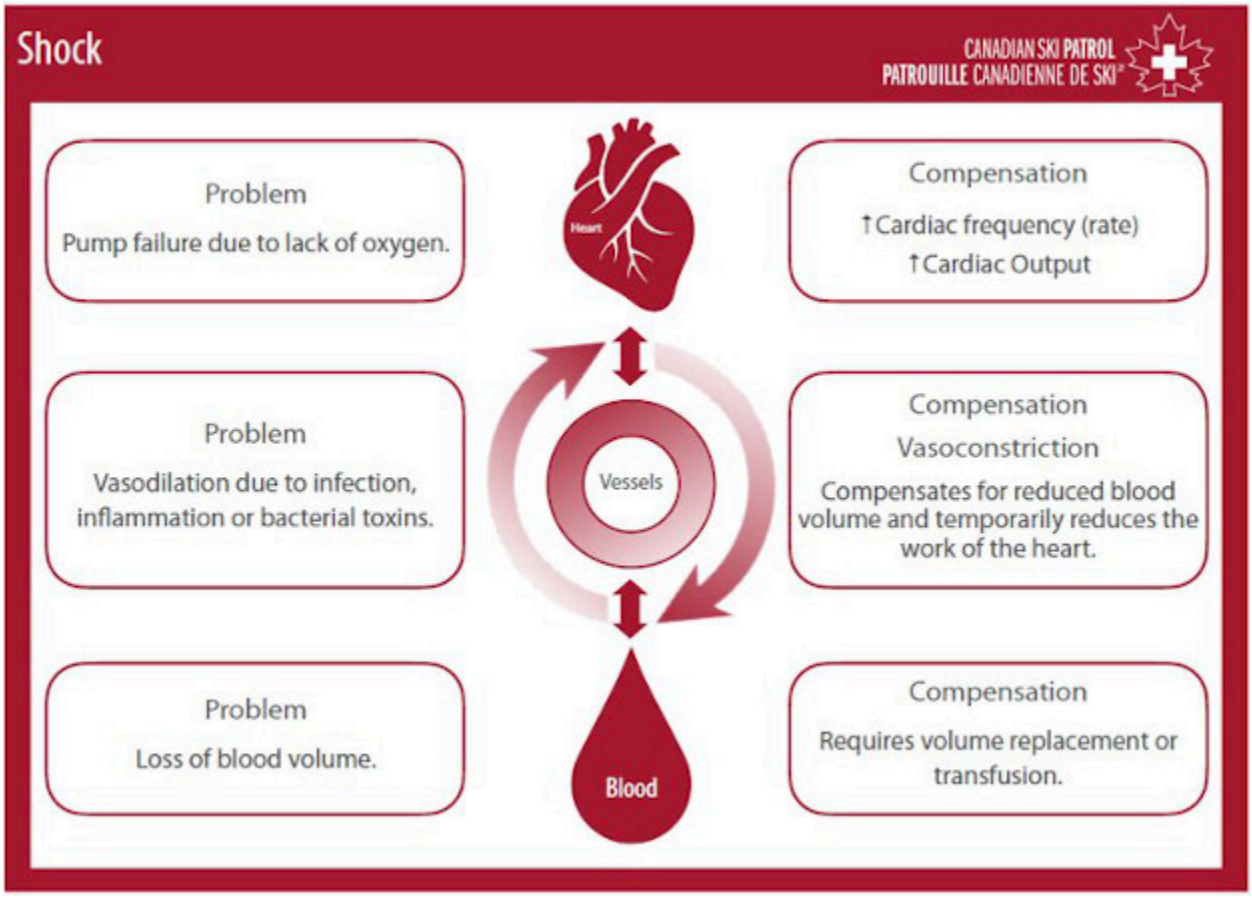

Figure 9-1: Components of Shock

Signs and symptoms of shock

Any or all of these signs and symptoms may be present. Note that many of these signs are changes in condition, and not just single observations.

Increased pulse rate

The pulse rate increases in an attempt to move more oxygenated blood to the cells.

Increased respiration rate

It is an attempt to increase the blood oxygen levels and increase elimination of carbon dioxide (CO2) via the lungs.

Pale, cool, clammy skin; delayed capillary refill; cool extremities

The body attempts to maintain blood flow to the heart, brain, lungs and kidneys by sacrificing blood flow to the digestive organs and the extremities. This is achieved by constricting the arterioles and redistributing blood flow. The result is pale, moist skin, cool extremities and ultimately absent peripheral pulses.

High anxiety, restlessness and aggression

It is due to reduced oxygen supply to the brain. Do not mistake this behaviour for lack of consent.

General weakness, dizziness and nausea

It is due to reduced oxygen supply to the brain.

Thirst

It is due to an attempt at restoring blood volume. This volume could also be lost through dehydration. Drinking fluids will not restore blood volume. With the shutting down of the digestive organs, the fluids will not be absorbed.

Decreased pulse strength

The volume of blood ejected by the heart becomes less. This decrease results in decreased pulse strength. The heart may not be refilling adequately, or it may not be emptying effectively, or there may not be enough blood to maintain the filling pressure.

Drop in blood pressure

It may be caused by either a combination of blood loss, loss of peripheral vasoconstriction and/or failure of the cardiac pump.

Decreased level of consciousness

It is due to a decrease in blood flow and oxygen supply to the brain.

Treatment for shock

Regardless of the cause or type of shock, the first responder treatment is the same.

- Stop external bleeding. Blood cannot be replaced in our environmental setting.
- Activate EMS and treat as a Load and Go.
- Administer oxygen at high flow rate.
- Keep the patient warm.
- Lay the patient down.
- Treat the patient gently.
- Give nothing by mouth.
- Closely monitor the patient.
- Record vital signs and history.
- Reassure the patient.

As required:

- Assure adequate breathing, assist ventilations.
- Move patient to recovery position in case of vomiting.
- Assist patient in taking their medication.
- Control bleeding, apply traction on fractures or compression to the pelvis if a pelvic fracture is suspected, and administer other first aid to address the cause of shock.

Make every effort to prevent the situation from deteriorating. All movement and temperature regulation requires blood flow which is in short supply during shock. Keep the patient quiet and ensure they are not too hot or too cold.

Types of shock

Cardiogenic shock

Cardiogenic shock occurs when the heart can no longer perform its pumping functions. It results in a lesser quantity of blood pumped per heart beat and hence less blood sent to the organs. The normal heart dynamic is affected. Examples include myocardial infarction (heart attack), the rupture of a heart valve or damage to heart muscle.

Hypovolemic shock

Hypovolemic shock occurs when circulating blood volume is lost. Examples of loss are active bleeding, dehydration or leakage of blood plasma out of the vessels due to burns or anaphylaxis.

Dehydration occurs with a lack of liquid intake or an increase in fluid loss usually over a longer time period, possibly due to large burns or prolonged vomiting/diarrhea.

The active bleeding leading to shock can be organized into compartments:

Internal hemorrhage

- thorax: such as hemothorax
- abdomen: liver, spleen, large vessels
- extremities: long bone fractures, hematomas, contusions

External hemorrhage

Laceration of any blood vessel following a fracture or a laceration to the surface of the skin.

Bleeding (hemorrhage) (hypovolemia)

The average adult body weighs 70 kg (154 lb.) and has about five litres of blood.

Any injury that disrupts the blood supply is potentially dangerous; the more blood loss the greater the danger. An estimate of blood loss is important in assessing the seriousness of a bleeding injury.

The condition deteriorates rapidly unless bleeding is arrested. Many small bleeds can be just as dangerous as one large one.

Hypovolemic shock

CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI

Blood Loss	Result
More than 20 per cent (about one litre)	Moderate hypovolemic shock
More than 30 per cent (about 1.5 litres)	Severe hypovolemic shock - life threatening

Failure to stop bleeding may lead to the progression of profound shock and eventually lead to death.

External bleeding

When a vessel is cut across its length, bleeding will usually stop without treatment. The elastic walls of the severed vessels cause them to contract and retract from the surface of the injury. As a result, large wounds may bleed very little. If a laceration runs the length of a vessel rather then

across then contraction will not be as easy and the wound will bleed more readily. Clotting helps seal the open vessels and prevent further bleeding. This process takes time. If the bleeding is brisk, clotting will not occur as quickly as needed, so the patroller must assist in stopping serious bleeding. The general treatment for external bleeding is remembered easily with the acronym RED, which stands for:

R.E.D	
R	**R**est: Lay the injured person down and rest the injured part (when possible).
E	**E**levate: Raise the bleeding part (when possible).
D	**D**irect: Apply direct pressure to the wound.

Arterial bleeding

The blood is bright red, flows in spurts, and may be profuse. The closer to the heart the injured vessel is, the more profusely it can bleed.

Venous bleeding

The blood is dark red (even bluish) and flows steadily. This type of bleeding is easier to control than arterial bleeding.

Capillary bleeding

The blood slowly oozes dark red, as would occur from a scrape. Often, due to the surface area of the skin involved, the danger from infection can be far greater than from blood loss.

Treatment

The most effective method of controlling external bleeding is to apply direct pressure to the wound. This stops the blood flow long enough for blood to coagulate.
(see Dressings, Bandages and Slings in Chapter 13)

General treatment for external bleeding injuries:

1. Quickly check wound for foreign objects.
2. Place your protected hand (or the patient's hand) on top of the wound and apply firm, direct pressure.
3. With as little movement as possible, apply a sterile dressing and a cravat, or other form of bandage, to the wound.
4. For severe bleeding, treat as for shock (don't wait for it to happen).

Treatment for bleeding injuries on the trunk:

1. Apply a sterile dressing and tape the dressing in place (see Bandages in Chapter 13). Cover the dressing over the wound by:
   - applying a bandage around the body, if it does not interfere with breathing
   - or, use a bandage for the chest and back
2. Transport to medical aid. Evaluate the need for a Load and Go. Was bleeding significant? Does the patient show signs of shock? Is breathing compromised? Are there other chest injuries?

3. If bleeding is not controlled after 10 minutes, maintain direct pressure with fingers or hands during transportation to medical aid.

Treatment for bleeding injuries to the extremities:

1. Check the limb for possible fractures, foreign objects, and gross contamination. Immobilize, stabilize and clean as required.
2. Apply a dressing and cravat, or other form of bandage, to the wound.
3. Tie the knot directly over the wound to maintain constant pressure, unless an underlying fracture is suspected.
4. Elevate the injury.
5. Check PMS before and after bandaging (see Pulse, motor response and sensation in Chapter 4).
6. Transport to medical aid. If PMS is compromised, activate EMS and treat as a Load and Go.
7. Severe bleeding may require the use of a tourniquet. (see Dressings, Bandages and Slings in Chapter 13)

Internal bleeding

Internal bleeding is loss of blood into compartments within the body. It can be organized in compartments depending on the affected organs. Signs and symptoms may or may not be evident in internal bleeding. Free blood in the abdominal cavity can irritate nerves resulting in pain, guarding and rigidity of the abdominal wall. It can also lead to the perception of pain in other locations such as the outer tips of the shoulders. Left shoulder tip pain is an indication of possible rupture of the spleen. Right shoulder tip pain may suggest injury to the liver or gallbladder.

Evident signs and symptoms

- If the patient coughs up bright red, frothy blood, then the source can be in the trachea or the lungs.
- If the patient vomits blood - this often has the appearance of coffee grounds - then the source can be the esophagus or the stomach.
- If the patient excretes blood mixed with feces (melena) - this often has a black, tarry appearance - then the source can be the stomach or the small intestines.
- If the patient has red blood from the anus the source can be a current injury to the colon, rectum or anus.
- If the patient has urine that is smoky or red in appearance, then the source can be the kidneys, ureter or bladder. There may be pain over the kidney area as well.
- It is important to note that any injury to the bowels (small or large), the stomach, or the bladder will more often result in free air in the abdomen and not internal bleeding.

Non-evident signs and symptoms

Internal bleeding resulting from a crushing type injury or from a blow to the abdominal region can be life threatening as the bleeding is not evident or easily identified. For example:

- bleeding into tissues associated with fractures may not be evident
- bleeding from the liver, spleen or pancreas occurs inside the abdominal cavity and does not appear outside the body
- the spleen may bleed into its capsule which may rupture at a later time, resulting in delayed symptoms
- bleeding from a kidney injury does not present with any abdominal compartment signs and symptoms
- the presence of hematomas (swelling) or ecchymosis (bruising) on the skin may indicate an important internal hemorrhage

Internal abdominal bleeding

Any of these signs and symptoms may be present:

- tenderness: increasing sensitivity to touch or pressure
- rigidity: shows up as a wooden or board-like feeling
- guarding: tightening of the muscles in the painful area

When examining for internal bleeding:

- Be gentle.
- Avoid poking and touching the patient with cold hands.
- Palpate each quarter of the abdomen separately, in turn. If you have reason to suspect injury in a certain area, palpate that area last. Note the quadrant with the injury: upper or lower, left or right.

Treatment

1. Activate EMS and treat as a Load and Go.
2. Treat for shock (don't wait for it to happen).
3. Transport the patient flat on their back with feet elevated no more than 30 cm, unless there is a risk of vomiting, in which case place the patient in recovery position.
4. Do not give anything by mouth.

Internal bleeding at a fracture site

Fractured large bones may bleed from the bone and marrow or from surrounding damaged tissues. A fracture at the mid-femur could sever the femoral artery.

Carefully examine the fracture site to determine if there is swelling. Even scarcely detectable swelling, associated with a fracture of the femur, may easily contain two litres of blood. This is above the tolerable limit of blood loss, yet there is no sign of external bleeding. Look carefully at all fracture sites and compare them with the opposite normal limb.

If there is obvious swelling, assume there is loss of blood.

Signs and symptoms of shock may be present as well as:

- pain, tenderness or discolouration where the injury is suspected
- bleeding from mouth, nose, rectum or other natural body openings

Distributive shock

Distributive shock is a general term referring to problems with peripheral vascular resistance. Blood vessels are normally kept in a state of mild (tonic) vasoconstriction to maintain blood pressure and ensure perfusion to organs. In distributive shock the blood vessels dilate even though instruction from the body calls for vasoconstriction. Hence, the same blood volume is in a larger container. The result is a decrease in blood pressure and a decrease in perfusion to organs and peripheral tissues.

Anaphylactic shock

Anaphylactic shock is a medical emergency. It is a severe allergic reaction that may occur when a patient inhales, ingests or is injected with a substance to which they are highly allergic.

These substances react with antibodies in the patient's system causing the blood vessels to dilate. The cell walls of the vessels become “leaky” (increased capillary permeability) causing

plasma loss to further reduce circulating blood volume and results in the hives and swelling associated with anaphylaxis.

Insect stings, shellfish and peanuts can cause a severe and rapid anaphylactic reaction. Allergic reactions may also cause severe swelling of the face and throat leading to blockage of the airway.

Septic shock

Septic shock results from severe infection and it is the most common form of distributive shock. The release of toxins from bacteria into the blood stream is at the centre of the problem. These toxins trigger dilation (opening) of the blood vessels. These dilated vessels are inefficient in the distribution of blood, thus disrupting the usual exchange of oxygen with the cells.

Common causes of septic shock are pneumonia, urinary tract infections, skin infections (cellulitis), intra-abdominal infections (such as a ruptured appendix), and meningitis.

Neurogenic and vagal shock

These types of shock result from a severe stress to the nervous system which fails to control the size of smaller blood vessels. A drastic drop in blood pressure occurs when blood leaves the larger vessels to fill the distended capillaries and stops circulating through the body. This same interference with the nervous system often results in slowing of the heart and in turn results in further drop in blood pressure.

Neurogenic shock

Neurogenic shock results from injury to the spinal cord, which disrupts nerve control of the blood vessel walls. High spinal injuries may also result in loss of cardiac sympathetic tone and warm skin due to dilation of the peripheral blood vessels.

The term neurogenic shock should not be confused with spinal shock which is a recoverable loss of function of the spinal cord after injury and does not refer to perfusion instability.

Vagal shock syncope (fainting)

Vagal shock is a case of simple fainting from either physical or emotional causes. Such stress can cause sudden dilation of the peripheral blood vessels. In turn the blood pressure drops and the brain is temporarily deprived of oxygen, causing a loss of consciousness. This is a temporary, self-correcting state. When the patient is lying horizontally, normal blood flow to the brain resumes and consciousness returns.

Check for any injuries as a result of the patient's collapse.

Obstructive shock

Obstructive shock is due to obstruction of blood flow outside of the heart. Many conditions can cause this form of shock.

Tension pneumothorax obstructs blood return to the heart as a result of the increased intrathoracic pressure and the distortion of the pulmonary blood vessels of the collapsed lung. There is reduced blood flow and eventually no flow of oxygenated blood back to the heart.

Cardiac tamponade is a condition where the sac surrounding the heart (pericardium) fills with blood restricting the filling of the heart with blood. Cardiac tamponade is most commonly associated with penetrating wounds to the centre of the chest.

Blockage of blood vessels can be caused by the movement of clots (pulmonary embolism), fatty tissue from a long bone fracture site (fat emboli) or compressed air bubbles (associated with scuba diving). In all cases the result is hindering the movement blood from or to the heart.

Aortic stenosis prevents circulation by obstructing the outflow of blood from the heart.

10. Head injuries

Learning outcome:

Recognize, understand, and treat head injuries.

Upon completion of this chapter you should be able to:

1. List examples of external and internal head injuries.
2. Recognize the signs and symptoms of head injuries.
3. Describe specialized considerations when treating patients with head injuries.
4. Describe the significance of changes in pupillary reactions to light.
5. Demonstrate the management of the unresponsive patient and of a patient who regains consciousness.

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- Jaw fractures 146
- Skull fractures 147

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- Cerebral contusion 149
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Head injuries

External head injuries can range from relatively mild lacerations to life-threatening blockages of the airway and heavy bleeding. These injuries are relatively easy to recognize and treat. Differences from the standard protocol for major bleeds and fractures are noted in this chapter.

Internal head injuries, such as concussions, can be less obvious yet are potentially more dangerous to the patient. If an internal head injury is suspected, the patient becomes a Load and Go, since the condition of the patient could deteriorate very quickly.

Whenever external trauma to the head is present, always suspect an internal injury, as well as c-spine injury. A simple bump on the head becomes a Load and Go when the signs and symptoms of a fracture or concussion are present.

External head injuries

Facial, scalp contusions and lacerations

Any trauma to the head is likely to be accompanied by external wounds. The main things to watch for are:

- airway problems due to bleeding in the mouth
- potential c-spine problems
- potential internal head injury

The mechanism of injury can be informative here.

Treatment of facial, scalp contusions and lacerations

The treatment of contusions or lacerations is routine (see Types of wounds in chapter 12). Special considerations with external head injuries include:

- The scalp is susceptible to heavy bleeding. Sufficient direct pressure may be difficult to apply with a bandage alone. Apply direct pressure by hand for a few minutes until clotting takes place.
- If there is a heavily bleeding laceration at the back of the head, place the patient supine with the head on a large dressing. The weight of the head will provide direct pressure.
- Swelling associated with closed wounds usually responds to ice packs.
- Never bandage around the jaw so that the patient's mouth will not open – in case there is bleeding from the mouth or vomiting. Use tape to secure a dressing.

Jaw fractures

Most often jaw fractures occur near the hinge. They can be one-sided or bilateral. These fractures are very painful and make it difficult for the patient to talk.

Signs and symptoms of a jaw fracture:

- facial deformity, asymmetry, or swelling differing from the patients normal appearance.
- difficulty in talking and swallowing
- bleeding
- inability to open the mouth or to clench the teeth
- bite irregularity
- pain

Treatment for jaw fracture

1. Maintain an open airway.
2. Administer oxygen only if saturation falls below 94%.
3. Stabilize the cervical spine: apply a cervical collar if it does not interfere with breathing or cause undue pain. If a collar cannot be applied, stabilize the jaw and stabilize the head with padding or blankets.
4. Stop any external bleeding with direct pressure. Use tape to secure a dressing.
5. Recommend the patient seek further medical aid.

Skull fractures

A simple skull fracture is not easily detectable and is not considered a serious injury in and of itself. However, many severe head injuries are associated with spinal damage and there are a number of associated injuries which can be serious or life-threatening. These may include:

- linear fracture (a break in the skull that follows a relatively straight line). These can occur at or beyond the point of impact
- depressed skull fractures: these injuries cause dents in the skull bone
- potential c-spine problems
- potential internal head injury

Signs and symptoms of skull fractures:

- Skull fractures may appear as an open or closed fracture, with or without detectable deformity. Examine the skull carefully during the secondary assessment.
- Depressed fractures may result in a portion of the skull pressing into the brain.
- Fractures of the base of the skull frequently result in bleeding from the ears, nose or mouth. Make sure this blood is not a result of laceration of the surrounding skin.

The clear, straw-coloured fluid which surrounds the brain - cerebrospinal fluid - may leak from the ears or nose as a result of a skull fracture. This type of injury should be suspected if a patient has sustained a severe impact to the jaw.

Treatment for skull fractures

1. Maintain an open airway. Be prepared to administer assisted ventilations if the patient's condition deteriorates. Activate EMS.
2. Administer oxygen if available.
3. Be on the alert for the presence or development of signs and symptoms of internal head injuries, they are indications of a Load and Go emergency.
4. Treat as for c-spine injury. Because head injuries are more likely to lead to an unresponsive patient, monitor carefully and be prepared to tilt the backboard to enable fluids to drain from the mouth and throat.
5. Bandage a dressing with enough pressure to stop external bleeding. However, if the skull is no longer rigid, do not apply pressure. Exercise caution and avoid depressing the fractured area.
6. If there is blood or clear fluid draining from the ears or nose, do not plug these orifices. Allow the fluid to drain. Apply a loose dressing and warn the patient not to blow their nose.
7. Your record keeping can be critically important in the case of head injuries. Inform medical authorities of the following:
    - Time and details of the incident.

- Presence or absence of signs and symptoms of spinal disabilities or internal head injury.
- Duration of unresponsiveness, if any.
- Pay particular attention to any change in vital signs and the pupils. Check them every five minutes.
- Blood or fluid appearing from ears, nose or mouth.

Internal head injuries

In increasing order of seriousness:

- concussion
- cerebral contusion
- intracranial pressure
- intracranial bleeding

Concussion

A blow to the head can cause a concussion (from the Latin concutere, "to shake violently," a very descriptive term). The trauma causes cerebral tissue to impact with the inside of the skull resulting in a temporary disruption of brain function; the effect is usually proportional to the magnitude of the blow. Although concussions are often associated with impacts with hard objects, they also occur when patients have been wearing helmets. Concussions are caused by the sudden deceleration of the skull followed shortly thereafter by the sudden deceleration of the brain that the cerebrospinal fluid cannot completely cushion.

A person who has experienced a blow to the head, consistent with concussion, should be encouraged to discontinue activity and seek medical aid.

If no other complicating factors are involved, there will be no damage or injury to brain tissue, only temporary neuronal dysfunction. However, since there is no way of knowing whether only a concussion is involved, and many of the signs and symptoms are similar to those of brain injury, all precautions applicable to brain injury should be taken.

Signs and symptoms of concussion:

A loss of consciousness, however brief, after a head injury is an unequivocal sign of a concussion but not of its severity.

Signs and symptoms of concussion are a lowered level of consciousness, ranging from the patient being slightly dazed to being completely unresponsive. Obvious external head injury is not a necessary condition, neither is loss of consciousness. Since the degree of damage is never obvious, an apparent concussion can lead to increased intracranial pressure. Carefully continue monitoring the patient.

Questions that can help discover symptoms of a concussion:

"Tell me again… what happened? …where was that? … when was that? … how or why did it happen?" If there are different answers now than you received during the primary assessment, consider the mechanism of injury and compare the patient's answers with the observations of others at the scene.

Look for the following:

Memory or orientation problems:

- general confusion
- memory loss
- unaware of time, date, place
- repeatedly asks the same questions

Typical symptoms:

- headache
- feeling dazed or "slow"
- dizziness
- seeing stars or flashing lights
- ringing in the ears (tinnitus)
- sleepiness
- loss of field of vision, double vision, blurred vision, light sensitivity
- nausea

Signs:

- poor coordination or balance
- vacant stare or glassy-eyed
- vomiting
- slurred speech
- slow to answer questions or follow directions
- easily distracted, poor concentration
- displaying unusual or inappropriate emotions (e.g. laughing, crying, swearing)
- personality changes

Treatment for concussion

1. Maintain an open airway. Be prepared to administer assisted ventilations if the patient's condition deteriorates. Activate EMS.
2. Administer oxygen if available.
3. Be on the alert for the development of more serious internal head injuries, they are a Load and Go.
4. Treat as for c-spine injury. Because head injuries are more likely to lead to an unresponsive patient, monitor carefully and be prepared to tilt the backboard to enable fluids to drain from the mouth and throat (see Spinal injuries in chapter 11).
5. Maintain normal body temperature.
6. Do not give any fluids.

Your record keeping can be critically important in the case of head injuries. Inform medical authorities of the following:

- time and details of the incident
- presence or absence of signs and symptoms of spinal disabilities or external head injury
- duration of unresponsiveness, if any
- pay particular attention to any change in vital signs and the pupils, check them every five minutes

A patient who has lost consciousness should be kept under medical supervision for 24 hours following the injury.

Cerebral contusion

Cerebral contusion is the bruising of brain tissue often caused by a blow to the head. Contusions commonly occur in coup or contre-coup injuries. In coup injuries, the brain is injured directly under the area of impact, while in contre-coup injuries it is injured on the side opposite the impact. There is a possibility of increased intracranial pressure developing.

Signs and symptoms of cerebral contusion

The signs and symptoms are the same as for a concussion but may be more pronounced or longer lasting. A serious contusion may also have symptoms of intracranial pressure or bleeding. Obvious external head injury is not a necessary condition, neither is loss of consciousness.

A return to consciousness is usually followed by a period of confusion and amnesia. A patient with a head injury may recover consciousness and insist on leaving. This patient should be kept under medical supervision for 24 hours following the injury.

Treatment for cerebral contusion:

Treat as a concussion.

Intracranial pressure

The skull can be thought of as a rigid box that contains a fixed volume. This constant cranial capacity contains a couple of components:

- fluid, both blood and cerebrospinal
- the brain

Any increase in either blood or cerebrospinal fluid leaves less room for the brain, assuming the skull is still intact.

A blow or injury to the head can cause bleeding or swelling inside the skull or the brain and often results in damage and/or impairment inconsistent with the size and severity of the original injury.

The rise in intracranial pressure has two major consequences. First, the pressure interferes with oxygenation of the brain cells, leading to hypoxia (inadequate oxygen supply). Hypoxia causes the deterioration of the patient's level of consciousness. In response to the resulting hypoxia, the brain blood vessels dilate as the body attempts to get more oxygen-rich blood to the brain cells. This tends to increase brain swelling even further, and results in raising the intracranial pressure even higher, continuing the deterioration.

Second, the pressure tends to push the brain stem down into the hole in the base of the skull, the foramen magnum, but it won't fit. The brain stem controls the basic life processes, most importantly, breathing regulation and heart function. The increased pressure compresses the brain stem which compromises those processes. Breathing gradually slows down and becomes irregular. Heart action gets stronger initially (bounding pulse) but also slows down more and more.

Intracranial bleeding

There is no way of knowing whether intracranial bleeding will occur following a head injury. Intracranial bleeding can take place outside or inside the lining of the brain, called the dura, which normally lies pressed against the inside of the skull. Bleeding outside the dura is called epidural, whereas bleeding inside the dura is called subdural. Signs and symptoms in either case may vary somewhat, but the treatment is the same.

The speed with which bleeding develops depends on the number and size of the damaged blood vessels. The symptoms may become apparent within a few minutes, a few hours, or may not appear for two or three weeks or longer.

Epidural bleeding

Epidural bleeding usually results from trauma to the arteries outside the dura precipitated perhaps by a fracture on the side of the skull.

Because arteries are high-pressure blood vessels, there is a rapid accumulation of blood in the epidural space, with a rapid rise in intracranial pressure.

Subdural bleeding

Subdural bleeding usually results from trauma or tears in the veins below the dura. Injuries to these blood vessels can be as devastating as to epidural arteries. However, symptoms of subdural bleeding have a slower onset that those of epidural bleeding because the lower pressure veins bleed more slowly than arteries. Thus, signs and symptoms may not show for several days or even weeks after an injury.

When taking the history of a patient who has signs and symptoms of a head injury, ask about head injuries that may have taken place days or weeks before.

Signs and symptoms of intracranial bleeding:

Following a head injury, there is no way of knowing whether intracranial bleeding will occur. The speed with which bleeding develops depends on the number and size of the damaged blood vessels. A typical chain of events is an initial period of lowered responsiveness, then an apparent recovery for one to 24 hours, after which the patient's level of consciousness starts declining.

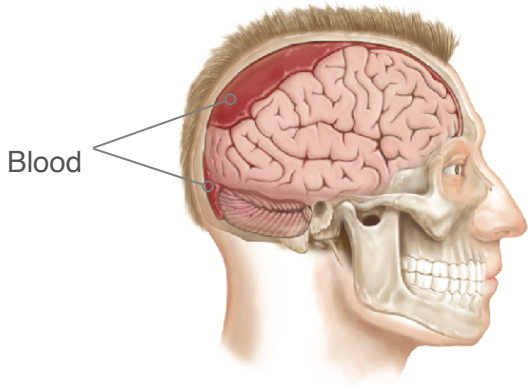

Figure 10-1: Intracranial bleeding

This injury is a true emergency that demands immediate attention.

Signs and symptoms may become apparent within a few minutes, a few hours, or they may not appear for two or three weeks or longer. They may include those of a concussion and any of the following:

- lowered level of consciousness including progressive or recurring loss of consciousness
- bleeding or fluid from the nose, mouth or ears
- convulsions, general or local
- nausea
- vomiting, especially by children
- any unusual pupil reactions such as described in the secondary assessment
- a bounding (high pressure) pulse and/or a very slow pulse
- cessation of breathing or patterned breathing
- partial or complete paralysis of the limbs, abnormal weakness of the limbs especially on one side, or loss of sensation in any part of the body
- discolouration behind the ears (Battle's sign)
- discolouration below the eyes (often known as raccoon eyes)
- abnormal or violent behaviour

- confused, disturbed speech pattern
- headaches which may be severe
- restlessness
- fatigue

The actual signs and symptoms may be minimal, so careful examination is very important. Any injury to the head where intracranial bleeding could be suspected, must be referred to medical aid (See Pupil reaction in chapter 4).

Treatment for intracranial bleeding:

Treat as a concussion.

Determine the level of consciousness.

If the patient is in full control of their faculties:

- Maintain close and continuous monitoring.
- The patient may appear normal, but close observation reveals slurred speech, slight disorientation, uncoordinated movements and weakness.
- Carefully note these signs and look for signs of alcohol or drug abuse.
- Smell the breath but never assume that apparent drunkenness is the result of alcohol.

Often, someone not feeling well may take a little brandy to settle their stomach and later suffer a stroke or heart attack. Many people put to bed to sleep it off have never awakened, because they had actually suffered a concussion or other head injury.

If the patient becomes unresponsive, this is an indication of possible intracranial bleeding. This is a serious complication.

If the patient is unresponsive check:

1. respiration
2. pulse
3. response of pupils to light
4. response to pain stimuli

If these signs are normal and stable, there is no immediate danger to airway or breathing. However, the situation may deteriorate.

- Monitor the patient continuously.
- Pay particular attention to the condition of the pupils.
- The patient may vomit; this is especially prevalent with children.
- Monitor and maintain the airway.

A patient with a head injury may recover consciousness and insist on leaving. This patient should be kept under medical supervision for 24 hours following the injury.

Treat the development of any of the following as a Load and Go:

- confusion
- deteriorating responsiveness
- abnormal pupil response
- vomiting
- weakness
- tiredness
- convulsions

Conclusion

For patrollers, the distinction between a concussion, a contusion, or worse is academic. Fortunately, diagnosis and treatment are the same. The severity of signs and symptoms - their number, strength, and duration - determine how fast the patient should be transported to medical aid. In the case of anything more than a simple laceration, the patient should always be advised to seek further medical aid to rule out complications.

The assessment and treatment of patients with a head injury should focus on:

- maintaining the patient's airway and breathing
- controlling bleeding
- spinal motion restriction
- careful and continuous watch for increasing intracranial pressure
- oxygen treatment
- assisted ventilations if breathing deteriorates or if increased intracranial pressure is suspected

The severity of brain injuries can be evaluated by monitoring:

- changes in the level of consciousness. Assess the patient every five minutes.
- pupil size and response
- extremity weakness

11. Spinal injuries and spinal motion restriction

Sustaining a spinal injury may be a traumatic and life-altering event for any individual. During and immediately following the event, the patient, if conscious, may be frightened, anxious and in need of support, both physically and emotionally. A patroller will be knowledgeable and skilled in recognizing and understanding spinal injuries and the treatment required. As importantly, they will also be knowledgeable, understanding and able to effectively communicate with their patient to explain all that is occurring during treatment and how the patient can assist in the sequence of events to move to the next level of care. Spinal injuries are not a frequently encountered injury, but when they do occur, it is critical that the patrol team be equipped to assess and treat injury effectively.

Learning outcome:

To safely and effectively assess and stabilize spinal injuries for transport to the next level of care while communicating effectively with the patient.

Upon completion of this chapter you should be able to:

1. Describe the mechanisms of spinal injuries.
2. Apply the spinal motion restriction protocol to make spinal motion restriction decisions.
3. Demonstrate the sizing and application of a cervical collar.
4. Demonstrate the loading and securing of a patient onto a SMR device (backboard, vacuum mattress, etc.) safely and with minimal patient movement.
5. Demonstrate the safe removal of a helmet from a patient with a possible spinal injury.
6. Demonstrate safely moving a patient from a prone position to a supine position.

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Spinal injuries

Spinal injuries are a relatively rare occurrence. However, the potential life impact of spinal and spinal cord injuries requires that patrollers maintain a high degree of suspicion and take steps to carefully evaluate whether an injury has occurred.

The spine can be injured by forces causing bending, flexing, extending, twisting, compressing or pulling apart the vertebra beyond their normal range of motion. All segments of the spinal column are vulnerable to these forces. The forces may act singly (unidirectional) or in combination with each other (multidirectional).

Falling on a slope lengthens the duration of the energy transfer, whereas falling straight down or hitting an immovable object results in energy transfer over a very short duration. The shorter the duration, the higher the forces involved and the more likely there is to be injury.

Several studies have noted that skiers tend to fall forward injuring the cervical spine, while snowboarders are more likely to fall backwards injuring the thoracic, lumbar or sacral spine. In addition, the number of injuries as a result of hard landings and crashes associated with large terrain jumps and drops from a height has been increasing in recent years. Injuries such as fractured heels and associated compression fractures in the lumbar spine have been noted at several ski areas with large terrain park jumps.

Patrollers may also encounter incidents resulting in spinal injuries during mountain and road bike events as well.

The closer to the head the spinal injury occurs, the more serious the consequences. Cervical spine injuries can have life-threatening consequences. Unlike peripheral nerves, severed spinal nerves do not regenerate.

Rough handling or incorrect treatment may worsen the injury.

Signs and symptoms of spinal injuries :

- great anxiety and reluctance for a conscious patient to voluntarily move their head or spine
- muscular stiffness/rigidity alongside the spinal column (self-splinting)
- pain in the midline of the neck or back
- TIC (tenderness, instability, crepitus) along the spine
- loss of movement in any extremity
- numbness, tingling or burning sensation in any extremity
- sudden onset of breathing difficulty following the incident
- a mechanism of injury with a high probability for spinal injury

Much of this information can be gathered as part of the scene assessment and by closely observing the patient's reactions to the event. A conscious, alert, cooperative patient without impairing agents (alcohol or drugs) and without any of the above signs or symptoms does not require spinal motion restriction.

Always consider the possibility of a spinal injury with a patient who is found unconscious or is suffering from a major head injury. If the patient is conscious, it is important to verify the medical history as the patient may have had a previous back injury or surgery. When in doubt, treat as a spinal injury.

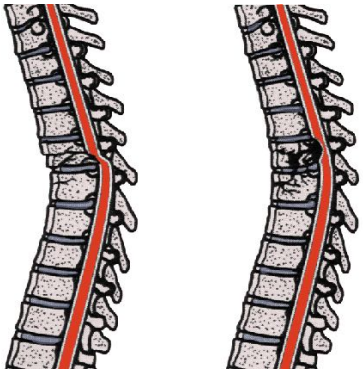

Figure 11-1: Damaged spine.

Complications due to spinal injuries

The spinal cord runs through the vertebral canal which is continuous through each vertebra. Pressure on the spinal cord may result from dislocated or broken fragments of vertebrae, creating loss of function of spinal nerves, complete or partial loss of power (paralysis) and/or loss of sensation below the level of the injury.

For example, a fracture of cervical vertebra C3, C4, C5 may paralyze the muscles responsible for breathing. Fractures in the thoracic or lumbar vertebrae may limit the ability to move, feel or perform some bodily functions voluntarily. Regardless of the exact location, all spinal injuries are treated carefully and with efforts directed to reducing any additional spinal motion.

The major steps in handling patients with (potential) spinal injuries are:

1. Be suspicious and evaluate the situation, the mechanism of injury, the site, and the patient's reactions.
2. Prevent further injury by following spinal motion restriction (SMR) procedures.
3. If deemed necessary, secure the patient to a suitable device for transport.
4. Reassess the patient and the need for continued SMR.
5. Provide patient status to EMS.

Prevent further injury

Stabilize the patient's head in a neutral position (if possible) until a decision of whether to proceed with SMR procedures or not is made. The neutral position means:

- the patient's eyes are looking straight ahead
- the nose, chin and sternum are in line
- ear canals are in line with the shoulders

Stabilization can be performed manually or by placing a pack alongside the patient's head. Gently conform your hands to each side of the head's contours. Your fingertips should not go beyond the jaw line. Try not to cover the patient's ears causing reduced hearing.

Asking the patient to not move and to remain still during the spinal motion restriction process is significant. Effective communication with, and the cooperation of, the patient is extremely important. The patient can be considered a key member of the team while managing this incident.

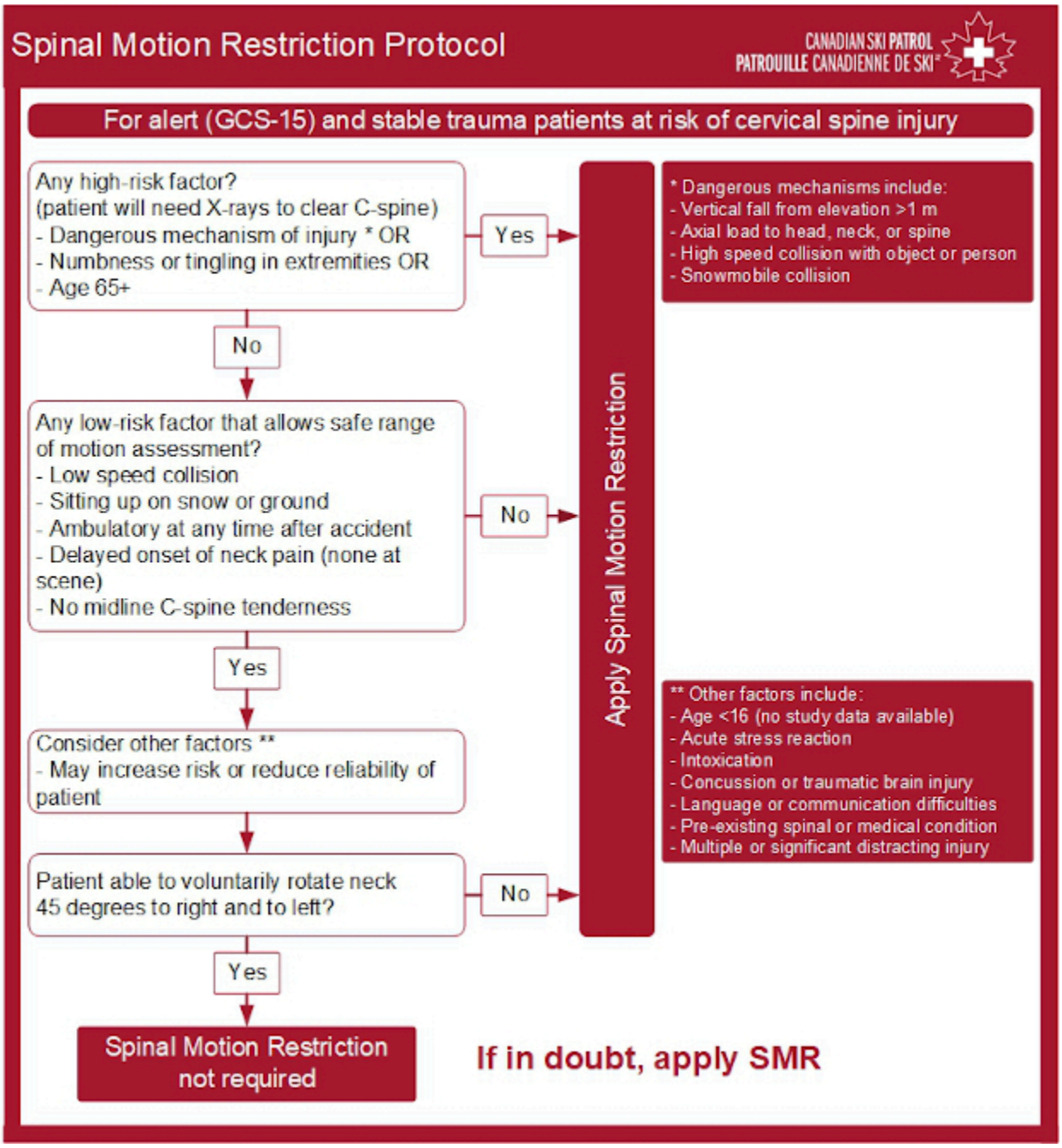
Spinal Motion Restriction Protocol
CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI
For alert (GCS-15) and stable trauma patients at risk of cervical spine injury
Any high-risk factor?
(patient will need X-rays to clear C-spine)
- Dangerous mechanism of injury * OR
- Numbness or tingling in extremities OR
- Age 65+
Yes
No
Any low-risk factor that allows safe range of motion assessment?
- Low speed collision
- Sitting up on snow or ground
- Ambulatory at any time after accident
- Delayed onset of neck pain (none at scene)
- No midline C-spine tenderness
No
Yes
Consider other factors **
- May increase risk or reduce reliability of patient
Patient able to voluntarily rotate neck 45 degrees to right and to left?
No
Yes
Spinal Motion Restriction not required
Apply Spinal Motion Restriction
* Dangerous mechanisms include:
- Vertical fall from elevation >1 m
- Axial load to head, neck, or spine
- High speed collision with object or person
- Snowmobile collision
** Other factors include:
- Age <16 (no study data available)
- Acute stress reaction
- Intoxication
- Concussion or traumatic brain injury
- Language or communication difficulties
- Pre-existing spinal or medical condition
- Multiple or significant distracting injury
If in doubt, apply SMR

Figure 11-2: Spinal Motion Restriction protocol.

Spinal Motion Restriction (SMR) Protocol

The SMR protocol is designed to help patrollers make an informed decision on whether to apply SMR. The goal is to identify every patient with a significant spinal injury and to reduce over-treatment of patients who are at low risk for a significant spinal injury.

People fall frequently, but not all require spinal motion restriction. A fallen patient who immediately stands up and wants to continue does not require SMR. Unnecessary SMR increases patient discomfort and anxiety, increases the risk of pressure sore formation and results in unnecessary utilization of EMS and patrol resources. A patient who is unconscious following a blunt traumatic event does require SMR.

In between these two extremes is the conscious patient who may or may not require SMR. The SMR protocol is based on extensively validated tools[1], including the Canadian C-Spine Rule, used to evaluate conscious, alert and stable patients who may have sustained a spinal injury and guide the patroller to making a yes/no decision about SMR and appropriate means of transport.

The SMR protocol is based on:

- identifying the need to apply it and the appropriateness of using it (inclusion criteria)
- identifying any high-risk factors (likely to have sustained spinal injury)
- identifying any low-risk factors (unlikely to have sustained spinal injury)
- confirming the ability of the patient to voluntarily move their head

Inclusion criteria are:

- 16 years and older
- alert and oriented (may not recall the details of the event) - GCS (Glasgow Coma Scale) =15 (see Glasgow Coma Scale in Chapter 4)
- no pre-existing vertebral disease
- acute, blunt injury less than four hours ago
- no penetrating spinal trauma
- no paralysis
- not already stabilized

High-risk factors

1. Dangerous mechanism of injury, including any event with high energy transfer:
    - vertical fall from elevations greater than 1 metre with an abrupt stop
    - axial load to the head, face or neck
    - high speed collision into another object or person with an abrupt stop
    - collisions in vehicles or snow mobile traveling over 15 km/hr
2. Any alteration in neurological status:
    - altered GCS (any score under 15)
    - change in sensation (numbness or tingling) or motor strength in any extremity
    - confusion or disorientation or memory loss. Not recalling the details of the event does not constitute confusion.
3. Age 65 years and older
    - these patients have a higher risk of bone injury or pre-existing bone or neurological disorders.

All patients with any high-risk factors should have SMR applied at the incident scene, with further assessment in the first aid room. These patients will likely need X-rays to assess their spine.

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[1] The SMR protocol is developed based on:
Canadian C-Spine Rule
NEXUS Criteria for C-spine imaging
Wilderness Medical Society Practice Guidelines for Spine Immobilization in the Austere Environment (2014 update)
Manitoba EMS Cervical Spine Clearance Protocol (revised October 2008)
Local protocol developed by Drs. Mulvey, Hanrahan, Lendrum, Wickham (Oct 2017)

Low-risk factors

The patient has a low risk of significant spinal injury if any of these low-risk factors apply:

- low speed collision or fall – an isolated ground level fall or slide
- sitting upright at the incident scene
- ambulatory at any time after the incident
- no neck/back pain at scene when asked versus immediate neck pain when the incident occurred
- no midline tenderness on palpation of the c-spine or remainder of the spinal column

Other factors

Other factors to consider include anything that reduces the patient's reliability or interferes with their ability to provide accurate history or respond to assessment movement or instructions, including but not limited to:

- significant distracting injuries that might mask the pain of a spinal fracture
- acute stress reactions (anxiety, etc.)
- brain injury, concussion GCS under 15
- intoxication or drug impairment
- language or communication difficulties
- pre-existing spinal condition (for example, known spinal disease or past spinal surgery, but not chronic lower back pain)
- age under 16 – no data is available to support use of this protocol. Use caution.

This is a difficult decision. Some of these patients can focus on a task or question you have given them and can be considered a reliable patient. If in doubt leave in SMR and re-assess in the first aid room.

Range of motion assessment

If the patient meets the inclusion criteria, has no high-risk factors, has at least one low-risk factor, the patroller can ask the patient to move their own head from side to side 45 degrees in each direction. If the patient does this voluntarily, despite any soreness they may feel, spinal motion restriction is not required. On the other hand, if the patient refuses or is unable, apply SMR.

Re-assessment

In all cases, the patient should be reassessed once they have been moved indoors into the first aid room. Clothing can be removed under more controlled conditions and a more thorough assessment can be conducted. CSP protocols for extraction and transport to the next level of care may differ from the EMS personnel protocols for treatment and transport following handover of the patient. This may involve removal or application of C-collars or backboards. These differences are appropriate and reflect the environment within which each organization operates.

Spinal motion restriction procedures

Requesting and explaining to the patient the importance of not moving to prevent any further injury and engaging the patient as part of the "team" is extremely effective. SMR can be applied using a variety of methods:

- vacuum mattress
- bilateral head blocks
- rolled blanket around the head and neck

- cervical collar

Primary objective: minimal movement.

Usually, a minimum of three patrollers are needed for the procedures defined below. This varies by:

- the location of the patient
- the size, weight and shape of the patient
- the availability of other patrollers

If life-threatening conditions are present, that is if airway, breathing or circulation (ABCs) are compromised, the patient may have to be moved by two or even one patroller.

Try to move the patient only once directly onto a backboard or other stabilization device.

These procedures attempt to place the patient on a rigid surface with as little movement to the spine as possible. Keep the body, from head to hips, in the anatomically correct orientation during the procedure.

The goal of the head-to-hip stabilization is to properly align and maintain the patient's head, spine and hips centred to the midline without introducing or applying spinal compression, traction, flexion, or rotation; this is known as axial stabilization.

The techniques described below refer to patrollers. There may be circumstances where the patroller in charge of an incident scene may decide to use bystanders to assist with rolling, straightening or securing the patient. In these cases, the patroller in charge is responsible for ensuring that the bystander is properly instructed on what their role is and that they understand the instructions before any movement of the patient occurs.

General points to remember:

- All patrollers should practice and review the backboard or vacuum mattress loading sequence regularly.
- If using bystanders, practice the loading sequence before moving the patient.
- When moving a person with a suspected spinal injury, the patroller at the head is always the one who co-ordinates the other patrollers stabilizing the rest of the body.
- A patroller other than the patroller at the head may have overall command of the incident scene for the purposes of triage, communication and co-ordinating transportation.
- The procedures described in this chapter may be used for femur, hip, and pelvic injuries as well.

Use the following procedures for suspected spinal injuries after you determine that the patient:

- has a clear airway
- is breathing
- has a pulse
- has no severe bleeding

If required administer oxygen.

If the patient is unresponsive:

1. always maintain a clear airway
2. be prepared that the patient may vomit

If the patient vomits:

1. roll the body or tilt the backboard or stabilization device towards you
2. clear the airway using the tongue-jaw lift (see Tongue jaw lift in Chapter 6)
3. finger sweep (see Finger sweep in Chapter 6).

Cervical collars

For a patient with suspected head and spinal injury, patrollers should initially use manually applied SMR. In a suspected cervical spine injury, it is recommended to manually support the injured person's head and neck in a position limiting angular movement until more advanced care arrives (e.g. placing one hand on either side of the injured person's head to hold it still). Requesting the patient not move their head using effective communication and gaining the cooperation of the patient is an important strategy for the patroller.

The use of cervical collars in all circumstances is not recommended. There may be occasions where the application of a cervical collar may not be in the best interest of the patient and the

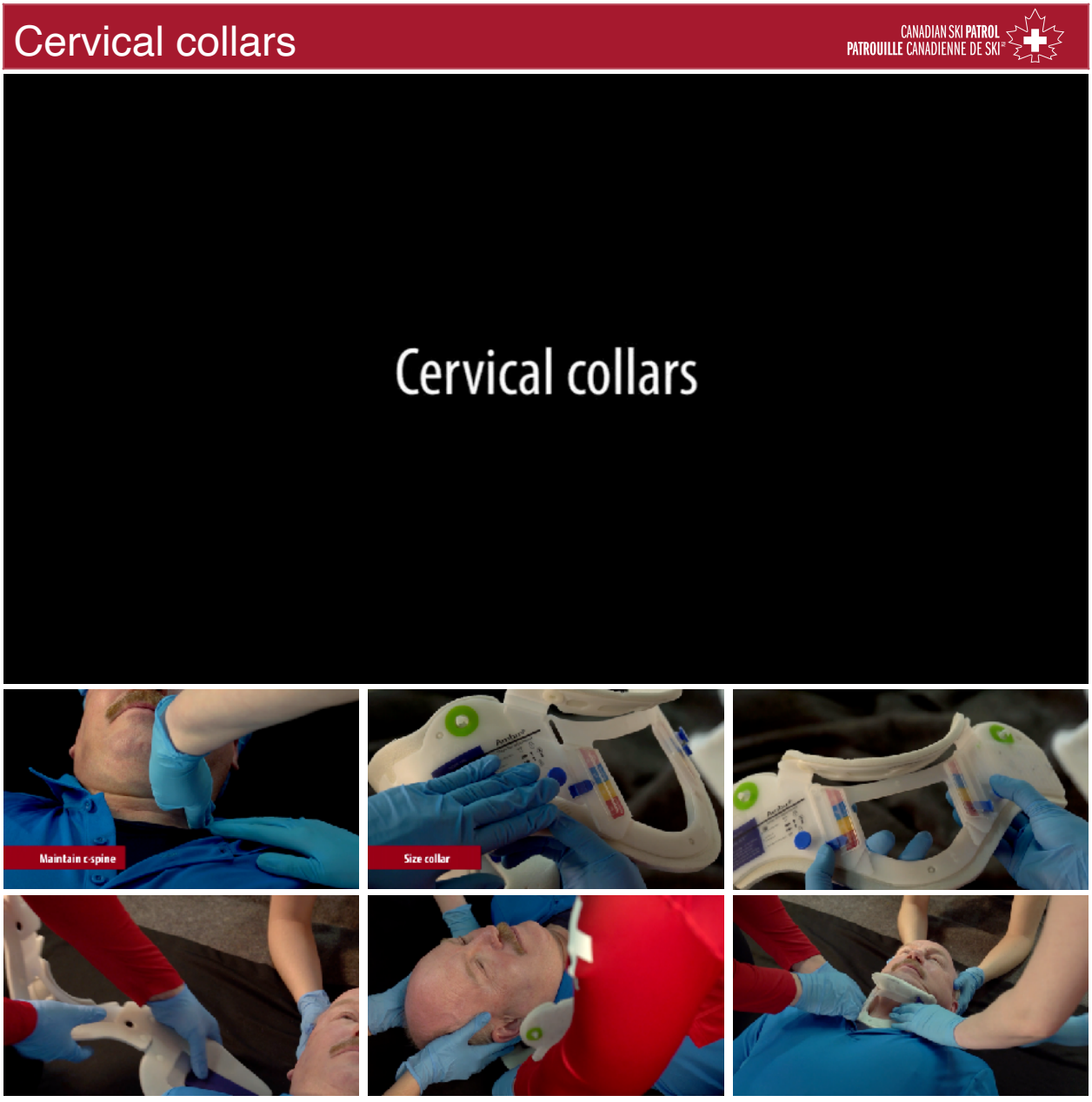

Figure 11-3: Applying a cervical collar.

patroller will be required to use the information gathered on scene to make a clinical decision whether or not to apply a collar. Considerations include instances where the application of the collar actually results in increased manipulation or movement of the neck potentially causing further injury. Examples may include:

- difficulty sizing and fitting a collar due to weather-appropriate clothing
- the work required and risk of heat loss to expose the neck to fit the collar properly
- the presence of helmets or other protective sporting equipment such as back armour
- patient condition/positioning
- injury to the jaw or clavicles

In these cases, a trained patroller maintains SMR by holding manual cervical spine control until full SMR can be applied utilizing other equipment such as blanket rolls, head blocks or a vacuum mattress without the use of a cervical collar.

The need for a cervical collar can be reassessed throughout contact with the patient and be applied at any time through the treatment period based on patient condition and environment.

In some special circumstances, commercially available, specialized stabilization devices (such as Kendrick Extrication Device, Sked, X-Collar and others) may be used for extrication. These immobilization devices are only to be used after proper training, following the manufacturers' guidelines.

To apply a cervical collar, the patient must be in a supine, sitting or standing position, with the head held in a neutral position by another patroller. The neck must be fully exposed for the collar to fit properly. In the winter setting, this requirement may negate the use of the cervical collar. The supine/ sitting requirement may not happen until the patient is rolled on to the backboard.

1. Explain to the patient what you are about to do and ask them not to move. Cervical collars must be tightly fitted. It is normal for the patient to feel discomfort at the points of the jaw.
2. Remove any necklaces (they obscure an x-ray) and, if possible, any earrings (for patient comfort). Winter clothing and helmets may hinder the proper application of a cervical collar. If so, consider other options to maintain c-spine control. Always consider the situation, the implications and the prevention of further injury including heat loss.
3. Size the collar to the patient. When in doubt, choose the smaller size to avoid hyper-extending the neck.
4. After determining the correct size, assemble the collar according to the manufacturer's instructions.

Follow the manufacturer's sizing and application instructions.

5. Flex the collar a few times to make it more pliable.
6. Fold the Velcro tab to the inside of the collar to prevent it from becoming contaminated with dirt or snow.
7. Slide the back of the collar under the patient's neck so that the Velcro strap slides completely to the opposite side of the neck.
8. Position the front of the collar beneath the patient's chin.

When applied, the chin cup should rest snugly against the patient's chin with the lower edge of the collar resting against the sternum. If the collar you first try does not fit, change it to the proper size before securing it to the patient.

9. Tighten the collar by gently pulling the strap and fastening it to the side of the collar. The collar should be tight enough to provide adequate support.
10. After application of the collar ensure it is not too tight. Ask the patient:
    - Can you breathe?
    - Can you speak?
    - Can you swallow?
11. If you have to re-adjust the collar, advise the patient that they will hear the Velcro strap tearing loose and that they should not be alarmed.
12. To the patroller at the head: Don't let go!

Be aware that even a properly sized, tightly fitted cervical collar does not completely stabilize the c-spine. It only reduces the extent of motion. It acts as a reminder to the patient not to move. The presence of a collar is a visual cue that the patient may possibly have a c-spine injury.

You can let go after the head has been secured on a backboard or in a vacuum mattress.

What if a cervical collar cannot be applied to the patient's neck?

Due to resistance felt when aligning the head, severe blunt trauma with progressive swelling or a penetrating neck injury, achieving a neutral head position may not be possible. Use of a cervical collar may not be feasible. Instead, ensure that the head and neck are adequately supported with padding and tape when securing the patient to a backboard. Pad under the head or the body to achieve alignment of the ear canal in the midline of the shoulder. Stabilize the head at all times.

Continue to communicate with, and reassure the patent throughout any spinal motion restriction procedures.

Roll techniques

Log Roll onto stabilization device

The log roll technique allows patrollers to use the ground as a type of splint and have greater control of the patient. The following procedure describes log roll onto a backboard for a patient found in the supine position using four patrollers. The same technique is used to log roll a patient onto another device such as a vacuum mattress (see Vacuum mattress below). If the patient is lying on their side, you will usually have to straighten the patient before continuing (see Straightening a patient with a spinal injury below).

1. Explain to the patient what is going to happen and how they can help by lying still.
2. Apply SMR as soon as possible.

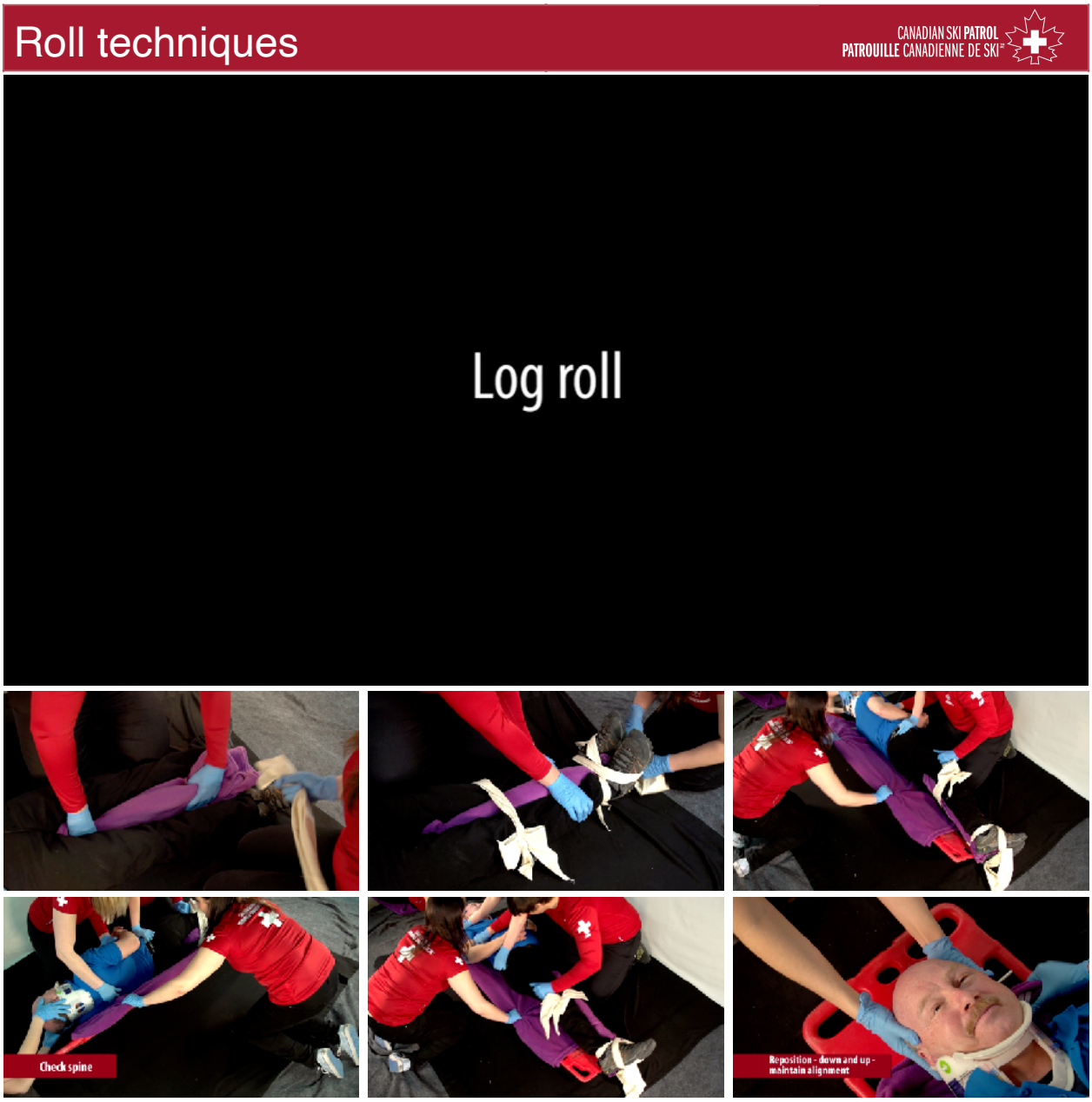

Figure 11-4: Log roll technique.

3. The patroller at the head is in charge of the log roll procedure while applying and maintaining axial stabilization at the head end of the head-to-hip axial stabilization.
4. Place two patrollers on one side of the patient. One level to the chest, the other level with the thighs.
5. If available, place a blanket between the patient's legs.
6. Secure the blanket with a broad bandage at the knees and a broad bandage at the ankles. This will prevent the legs from dangling and getting in the way. If available the patroller at the patient's feet stabilizes the legs.
7. If the patient is unresponsive, loosely tie the patient's hands together with a cravat bandage.
8. Position for patrollers at the head and feet:
   - Given that the patrollers at the head and feet may stay in that position for an extended period of time, they must assume a very stable and comfortable position. Their hand positioning will be dependent on the direction of the roll.
   - Patrollers who will roll the patient must also assume a stable and comfortable position.
9. Apply and maintain head to hip axial alignment and stabilization.

   Do not introduce spinal compression or traction during movement.
10. The patrollers assisting with the roll, position their hands as follows:
    - The patroller at chest level reaches over the patient and places one hand at the shoulder level and the other just below the hips.
    - The patroller at the thighs reaches over the patient and places one hand just above the patient's hips (criss-crossing arms with the other patroller) and the other hand at the knees.
    - This criss-cross position effectively locks both assisting patrollers, enabling them to move the patient as a unit.
11. The patroller at the head verifies if everyone is ready. Once everyone is ready, the patroller at the head gives the command to roll the patient onto their side, as far as is necessary to insert the backboard under the patient.
12. Check the patient's back for TIC and DCAP-BLS. Place a blanket or closed-cell foam pad, on the backboard prior to loading the patient. This greatly eases the relocation of the patient prior to the tie down and reduces the potential for the development of pressure sores due to prolonged stabilization on the backboard.
13. Align the backboard to the patient so that the patient's ears align with the top tie down position.
14. Position the backboard and hold it as tightly as possible to the patient, preventing the board from slipping or twisting.
15. On command from the patroller at the head, the patient is rolled onto the backboard. The backboard is lowered to the ground with the patient.
16. If the patient needs to be moved on the backboard to centre and align the ears with the first slot on the backboard, then the patroller at the head gives directions to move the patient while axial stabilization is still maintained.
17. Secure the patient to the backboard (see Secure patient for transport below).
18. Maintain axial stabilization until the patient is stable on the backboard.

Due to certain terrain conditions, you may have to tie a patient to the backboard before the patient is stable on the board.

It is possible to perform a log roll using three patrollers:

- One patroller stabilizes the head, the second assumes the side position at chest level and the third positions and controls the backboard.
- Ensure that axial stabilization is maintained throughout the manoeuvre.

Straightening a patient with a spinal injury

You may find a patient with a spinal injury wrapped around a tree, post, mogul or other object which cannot be moved. In such cases, where the patient is probably on their side, the log roll is the preferred method for placing the patient on the backboard. Apply axial stabilization between the head and hips before proceeding to move the patient. Communicate with the patient, explaining what will occur as well as how and when. Also explain how the patient can assist with the procedure.

Figure 11-5: Straightening a patient.

Straightening procedure

Some of the following steps may not be practical due to the circumstances of the incident and the availability of patrollers. Where possible:

1. Stabilize the head and body and apply a cervical collar if needed or possible. Reminder: to apply a collar, the patient must be supine with the neck in a neutral position.
    - You may need to use non-compressible padding under the head to get the eyes-forward position.
2. Position of thighs and knees:
    - If the thighs and knees are together, secure them with a broad bandage.
    - If the thighs and knees are not, wait until axial stabilization is applied at the head and hips before placing them together.
3. If the patient is unresponsive, loosely tie the patient's hands together with a cravat.
4. If patrollers are available, position them as follows:
    - One patroller at the head to stabilize and apply axial stabilization
    - One patroller at the chest to stabilize the shoulders
    - One patroller at the hips
    - One patroller at the feet to straighten the legs.
    - Be careful not to introduce traction or compression at the head to hip area during the manoeuvre.

- It is also possible to perform this procedure with only three patrollers:
- One patroller stabilizes the head.
- The second patroller takes position at the hips.
- The third patroller at the feet, places the feet together and stabilizes the lower legs until patient is straightened.
- Should any resistance or increased pain be detected while applying axial stabilization and straightening, stop and stabilize the patient in the position found.

5. The patrollers positioned at the head and hips maintain head to hip axial stabilization.
6. The patroller at the chest applies pressure towards the midline.
7. The patroller at the feet brings the legs together and then straightens them slowly and carefully.
8. Once the patient has been straightened, maintain head-to-hip axial stabilization.
9. The patrollers then place their hands in the proper position to perform the roll onto the backboard.
10. Quickly examine the patient's back (TIC and DCAP-BLS) as they are rolled onto the backboard.
11. Secure the patient to the backboard.

Patient found face down

You may find a patient lying face down either breathing, or not breathing. First Aid techniques vary accordingly. Always communicate with the patient, explaining what will occur as well as how and when. Also explain how the patient can assist with the procedure.

Figure 11-6: One patroller roll for a prone patient.

Patient found face down and breathing

This procedure is similar to the log roll. You will require the same number of patrollers. The major difference between the two procedures is that you start with the patient in the face down position.

Always perform the roll in the direction of the back of the patient's head. The roll must be performed in a manner that causes the least amount of movement to the patient's head and neck.

1. Always explain to the patient what is going to be done and that they can help by lying still.
2. Immobilize the patient's head in the position found. The patroller at the head must be sure of their hand positions before actually rolling the patient. Think about where your hands will be after the patient has been rolled.

3. If a blanket is available, place it between the patient's legs and secure the blanket at the knees and feet.
4. The other patrollers assume the positions as outlined in the face-up log roll procedure.
5. On command from the patroller at the head, roll the patient to a lateral position on their side.
6. Position the backboard between the patrollers on the side and behind the patient's back.
7. Roll the patient onto the backboard and lower to the ground as a unit.
8. Apply a cervical collar, as appropriate.
9. Secure the patient to the backboard.

Patient is found face down and not breathing

Speed is critical:

1. Gently place the patient's arm closest to you alongside the patient's head.
2. Cross the patient's outside lower leg over the inside lower leg.
3. Use one hand to grip the patient's waist.
4. Using your other hand to support the head, roll the patient onto their back.
5. Begin the rescue breathing techniques described in basic life support (see Artificial Respiration (Rescue Breathing) in Chapter 6). If available, a second patroller should stabilize the head at all times.

Secure the patient for transport

The desired outcome is to maintain spinal motion restriction, reducing patient movement and transport the patient safely. Always communicate with the patient, explaining what will occur as well as how and when. Also explain how the patient can assist with the procedure by providing critical feedback. The patroller stabilizing the head has the primary responsibility to maintain this communication.

It is the patroller's responsibility to establish a method of transporting the patient while maintaining an open airway and preventing movement that will cause further injury.

If unable to move the patient because of their location or injuries, call for further patrol assistance and/ or the appropriate EMS immediately. Assist the emergency personnel as requested.

Tie down procedures using triangular bandages

1. Fold blanket around the head
2. Tie the crosses, chest to legs
3. Tie the feet
4. Tie broad bandages, chest to knees
5. Tie the head

Some of the following steps may not be practical depending on the circumstances of the incident. If available and properly trained in their usage, patrollers may use a head immobilizing device such as Ferno head blocks (see Figure 11-7) and use speed-clips or spider-straps in replacement of the triangular bandages.

Figure 11-7: Head stabilization device

Secure the patient for transport

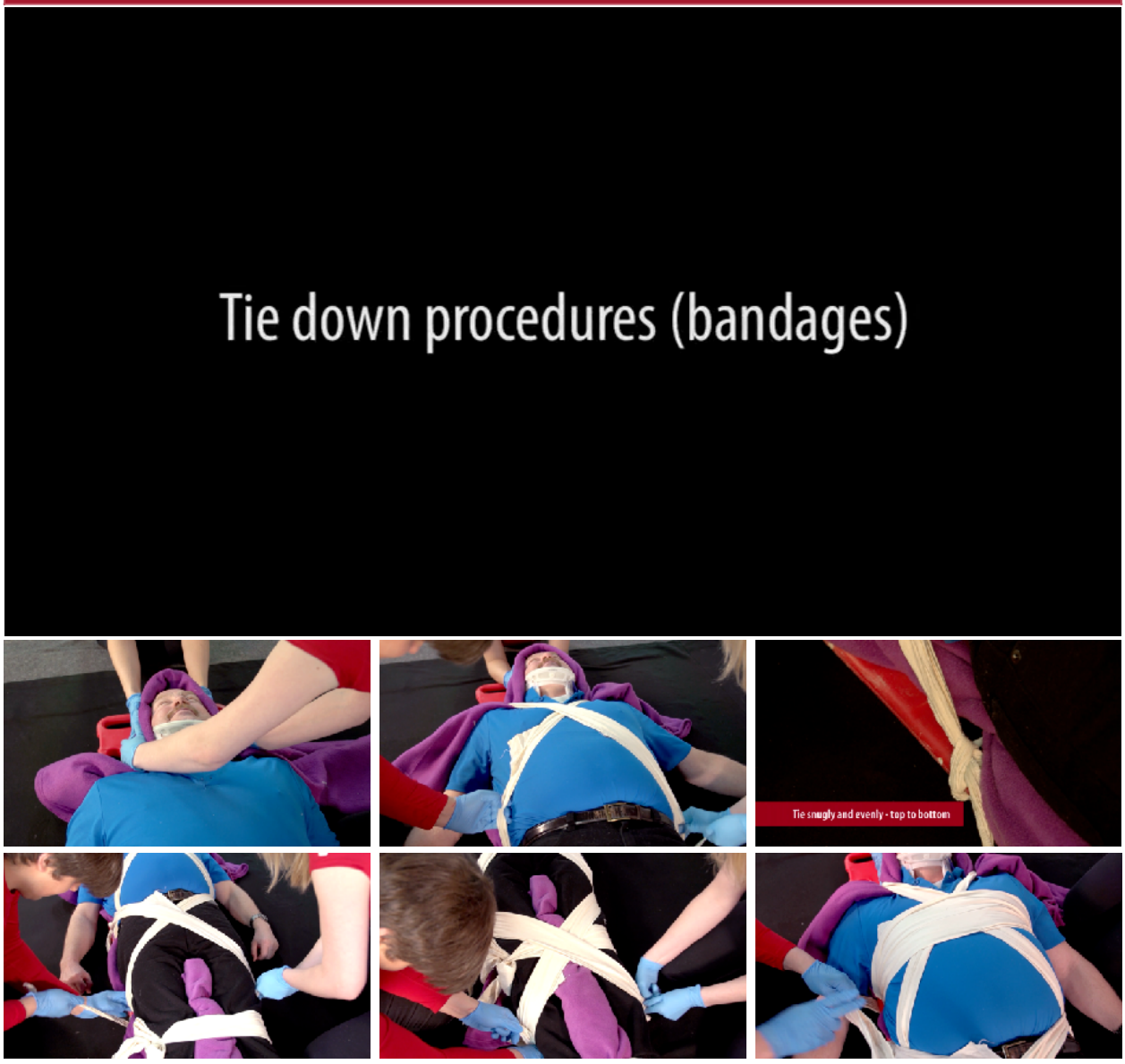

Figure 11-8: Securing patient torso and legs.

Where possible:

1. Place a folded blanket around the patient's head. The blanket should extend beyond the patient's shoulders.
2. The patroller positioned at the patient's head will continue to stabilize the head by placing their hands on each side of the patient's head. The finger tips should be placed along the cervical collar, approximately at the jaw line.
3. If padding is needed to prevent movement, roll two blankets and place them under the armpits and down each side of the body. If a blanket was used on the backboard, the excess may be used as padding along the sides.
4. Two patrollers simultaneously tie cravat bandages over the chest area in criss-cross fashion. Start by tying the bandage end to a slot at ear level, come over the blanket on the patient's shoulder and across the chest. Feed the end through a slot above the hip, tell the patient to

take and hold a deep breath while the two patrollers tie the ends. The padding over the shoulders will prevent the bandages from sliding into the cervical collar.

5. After securing the bandages confirm that the patient is still able to breathe properly.
6. Apply another set of criss-crossed cravat bandages across the patient's hips.
7. Place padding under the knees, to fill the hollow.
8. Apply another set of criss-cross bandages over the knees. Be careful not to over-tighten this bandage.
9. Use two triangular bandages to apply a broad bandage over the ankles and secure to the board.
10. Tie broad bandages across the patient's chest, hips, and legs (above or below the knees).
    - Ensure that the bandage at the chest or abdomen does not impair the breathing in any way. Snug is good.
    - Ask the patient if the bandages are too tight and check them yourself.
11. Tie a broad bandage so that it covers the eyebrows of the patient. Do not use a chin strap as it may prevent fluids from draining and prevent the patient from communicating.
12. Tie one end of a triangular to the side of the brow bandage around the criss-cross of the chest bandages and then to the other side of the brow bandage.

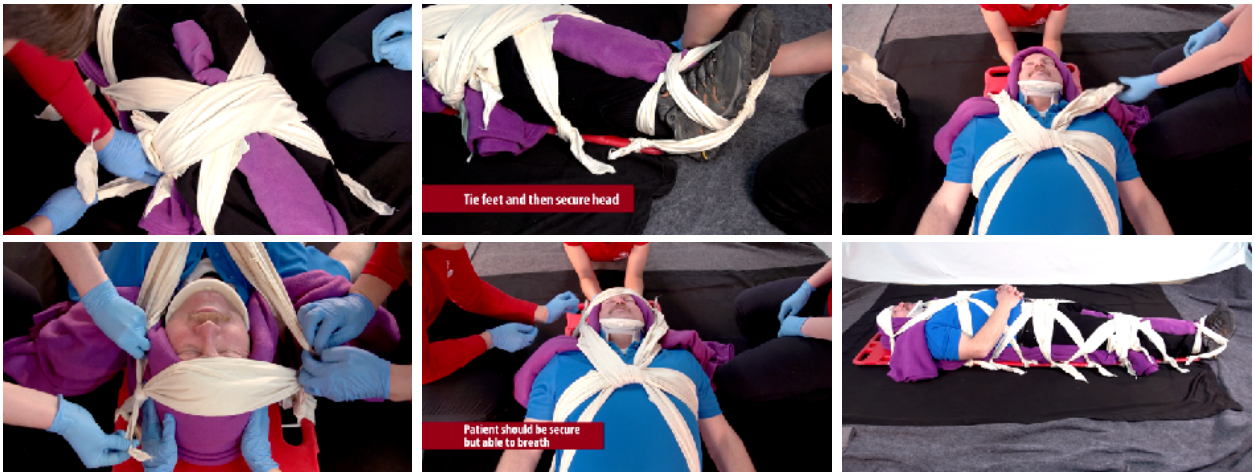

Figure 11-9: Secure patient feet and head.

Many resorts or events employ commercial tie down strap systems. Patrollers will be trained in their use at their resort or event. The tie down with triangular bandages ensures the desired outcome, principles, sequence and teamwork of securing a patient to the backboard is fully understood.

General points of consideration

Where possible, apply the following guidelines:

- Use as many bandages or as much padding as required to prevent movement.
- Bandages applied with too much pressure may affect breathing or cause pressure on the spine.
- Do not put direct pressure on the knees.

Do not secure the patient's head to the backboard until all other tie down procedures are complete. This eliminates the possibility of spinal injury if the patient slides off the backboard or vomits while only the head is secured.

Scoop stretcher

When a scoop stretcher is used, each side is separately inserted under the patient from the side. The sides are then re-fastened and the patient is securely immobilized to the stretcher with straps or cravats. Axial immobilization must be maintained throughout this procedure.

For Information only

Use of an upper body motion restriction device.

Patrollers may be asked to assist more advanced medical responders to immobilize a patient with an upper body motion restriction device. The Kendrick Extrication Device (KED) is one example. The strapping system on an upper body motion restraining device mirrors a typical backboard and is very familiar to patrollers and simple to learn.

The device however, is not part of the standard equipment found at all CSP areas, due to its cost. Devices such as a KED may be used by our members provided the manufacturer's instructions for use are followed.

Vacuum mattress

A vacuum mattress is a whole-body stabilization device. It is a flat, sealed, flexible pouch filled with particulate about the size of sand or gravel. A valve allows air to enter and to be pumped out of the pouch. The pouch is formed to a patient's contours by folding it and moving the particulate to fill hollows. Pumping the air out of the pouch results in a rigid, contour-moulding stabilization. The operating temperature range is -40°C to 70°C. Follow the manufacturer's instructions when using a vacuum mattress.

Documented benefits of the use of vacuum mattresses for the stabilization of casualties include:

- the reduction of pain (e.g., occipital headaches, sacral, lumbar and mandibular pain) associated with pressure points
- increased comfort, support in the hollows (e.g., small of the back)
- reduction of "squirming" to relieve discomfort associated with pressure points
- better stabilization of the cervical spine in extension and lateral flexion
- quick application and fewer transfers of patients from one device to another

The following provides general guidelines for the use of a vacuum mattress instead of a backboard; however, equipment and policies for use may vary from centre to centre. Training on the use of the vacuum mattress is the responsibility of each local ski centre where they are used.

Log roll onto a vacuum mattress

This technique is similar to that described for log rolling a supine patient onto a backboard (see "Log roll"). Apply manual SMR if necessary; the vacuum mattress, with or without a soft cervical collar applied, will maintain SMR once it is fully formed around the patient's head.

1. Remove the vacuum mattress from its carrying bag.
2. Unfold the mattress on a flat surface, ensuring that there are no sharp objects underneath (e.g., rocks, broken tree branches, glass) that could puncture the mattress.
3. Open the valve, distribute the particulate evenly throughout the mattress and flatten bumps in the centre of the mattress with brushing hand motions vs. slaps to the mattress.

Figure 11-10: Loading and extraction with vacuum mattress.

4. With the valve in the open position, install the pump. (Notes: ensure that there is no snow, ice or other debris in the valve opening or the pump hose.)
5. Partially stiffen the mattress by pumping out sufficient air that it forms a flat surface.
6. Close the valve.
7. Align the vacuum mattress to the patient so that the patient's head and shoulders are in the correct position according to the manufacturer's instruction.
8. Place a blanket on the mattress. (Notes: Since a vacuum mattress is wider than a backboard, repositioning of the patient is a frequent occurrence. The use of a blanket aids in the repositioning and can have the added benefit of providing an insulating layer between the patient and the surface of the mattress.)
9. Position the mattress flat on the ground and tuck it under the patient as far as possible.
10. Log roll the patient onto the mattress, using the same technique described for log rolling onto a backboard. Apply and maintain manual SMR if necessary.
11. Under command from the patroller at the head, reposition the patient to the correct head and shoulder position on the mattress, using the blanket, while maintaining axial stabilization and stabilization.
12. If necessary, place a folded blanket around the patient's head or use a soft cervical collar to maintain SMR.
13. Open the valve to let air enter the vacuum mattress and allow redistribution of the particulate around the patient.
14. While maintaining the head in a neutral position, mould the sides of the mattress around the head and neck such that the forehead is higher than the folded sides. (Notes: As with standard backboard procedures, maintain a neutral alignment of the head and do not move the head or neck while moulding the mattress. With assistance from another patroller to maintain SMR while he does so, the patroller at the head can remove his hands from inside the mattress and reposition them on the outside.)
15. Mould the sides of the mattress to the patient's body and attach the straps according to the manufacturer's instruction, starting at the shoulders and working down to the feet.
16. Pump the air out of the mattress until it is fully stiffened and formed around the patient's body.
17. Close the valve.
18. Readjust straps as necessary. (Notes: As with a standard backboard, it is acceptable to have the patient take a deep breath before tightening the straps; if the patient is unconscious, ensure that there are no breathing restrictions.)
19. Fasten the forehead strap last, or apply tape around the mattress and forehead.
20. Transport by using the handles along the sides of the vacuum mattress. Normally, two people are positioned along each side.
21. Patient is log rolled and back checked.
22. Patient is rolled onto blanket and centred.
23. Mattress is moulded around patient.
24. Patrollers must maintain the mattress in its moulded form while the air is being removed.
25. Straps are tied.
26. Patient is transported.

Notes and on-snow adaptations

- On uneven or soft snow surfaces a standard backboard placed under the vacuum mattress can provide a flat and firm working surface.
- When using a vacuum mattress and it is necessary to perform CPR, it is standard procedure to place a backboard underneath the vacuum mattress in order to provide a firm working surface.
- On inclined or slippery surfaces, it is essential to increase the friction between the vacuum mattress and the snow surface. This can be done using blankets or carpet under-padding. At least one rescuer should have a hand on the vacuum mattress at all times to prevent a runaway. Attaching the mattress to an anchor point is also effective.
- When wearing ski boots, the pump operator should guard against the pump slipping out from underneath their boots on the up-stroke, as the pump is dual action. One adaptation is to kneel and place the pump between the legs.
- When airlifting or otherwise transporting a patient by means of a rescue basket, a standard backboard or other suitable device should be placed under the vacuum mattress to provide support.

Contraindications

- Claustrophobia
- Children under 7 on an adult-size mattress

Other vacuum mattress situations

A vacuum mattress can be used in most situations where a backboard is used, including:

- spinal stabilization
- pelvic fracture stabilization
- femur fracture stabilization.

For patients who cannot be straightened into the preferred log roll position (see Log roll) the vacuum mattress can be formed around the patient in the position found.

For pelvic fracture stabilization (see Pelvic girdle fracture in Chapter 15), a circumferential pressure device or broad bandages around the pelvis should be applied before the patient is rolled onto the mattress. The stiffened vacuum mattress will provide additional pressure to stabilize the pelvis.

For single or bilateral femur fracture stabilization (see Femur fractures in Chapter 15), realign the limb, secure the legs together before the patient is rolled onto the mattress and then apply traction using a stirrup bandage. Counter traction is applied by using several bandages tied together to form a long loop which is placed around the top of the leg and is held by a patroller at the patient's shoulder until the mattress is stiffened. The stiffened vacuum mattress will maintain the applied traction.Mattress is placed beside patient.

Standing stabilization

If the patient is standing and a spinal injury is suspected, stabilization can be performed safely while standing. This technique takes three patrollers but is easier if four are available. If a bystander is recruited, they should be used to support and control the backboard.

1. Talk to the patient to let them know what will be happening and to reduce their anxiety.
2. Have one patroller size and apply a cervical collar, if required and possible, while the other maintains spinal motion restriction (SMR).
3. Place the backboard behind the person. Check the placement of the backboard from the front of the patient to ensure it is aligned correctly. Check the alignment of the patient's head from the side to ensure the head is in a neutral position. Pad under the head or shoulders as needed to achieve a neutral head position.
4. With one patroller on each side of the patient and facing in the direction of travel, each should place their arm closest to the patient, under the patient's armpit and grasp the next highest handhold on the backboard. The patroller's free hand supports and holds the patient's head in alignment throughout the lowering. In cooperation with the patroller maintaining SMR from the front of the patient, transfer responsibility for c-spine to patrollers at the sides. The third patroller moves around to the back of the board and holding the top edge with palms up, guides the board throughout its arc to the ground.
5. Have the patient hold their arms across their chest. The timing of the move to the ground is set by the patroller supporting the backboard. Talk to the patient and reassure them throughout the process. Tip the backboard backward and lower the backboard to the ground

Figure 11-11: Standing stabilization.

while holding the patient's head stable. The patrollers will need to move from a standing to a kneeling position during the tip backwards.

6. Once the patient is horizontal and stable, transfer SMR responsibility to the patroller at the head and complete the process of securing the patient to the backboard for transport. After the patient is completely stabilized and secured to the board, manual SMR is released.

Helmet removal

A helmet should only be removed if it is interfering with the assessment and treatment. In order to safely remove a helmet the patient's head must be maintained in the neutral position through manual application and maintenance of SMR, whether the patient is supine, sitting or standing. They cannot be prone or on their side. The described procedure requires two patrollers.

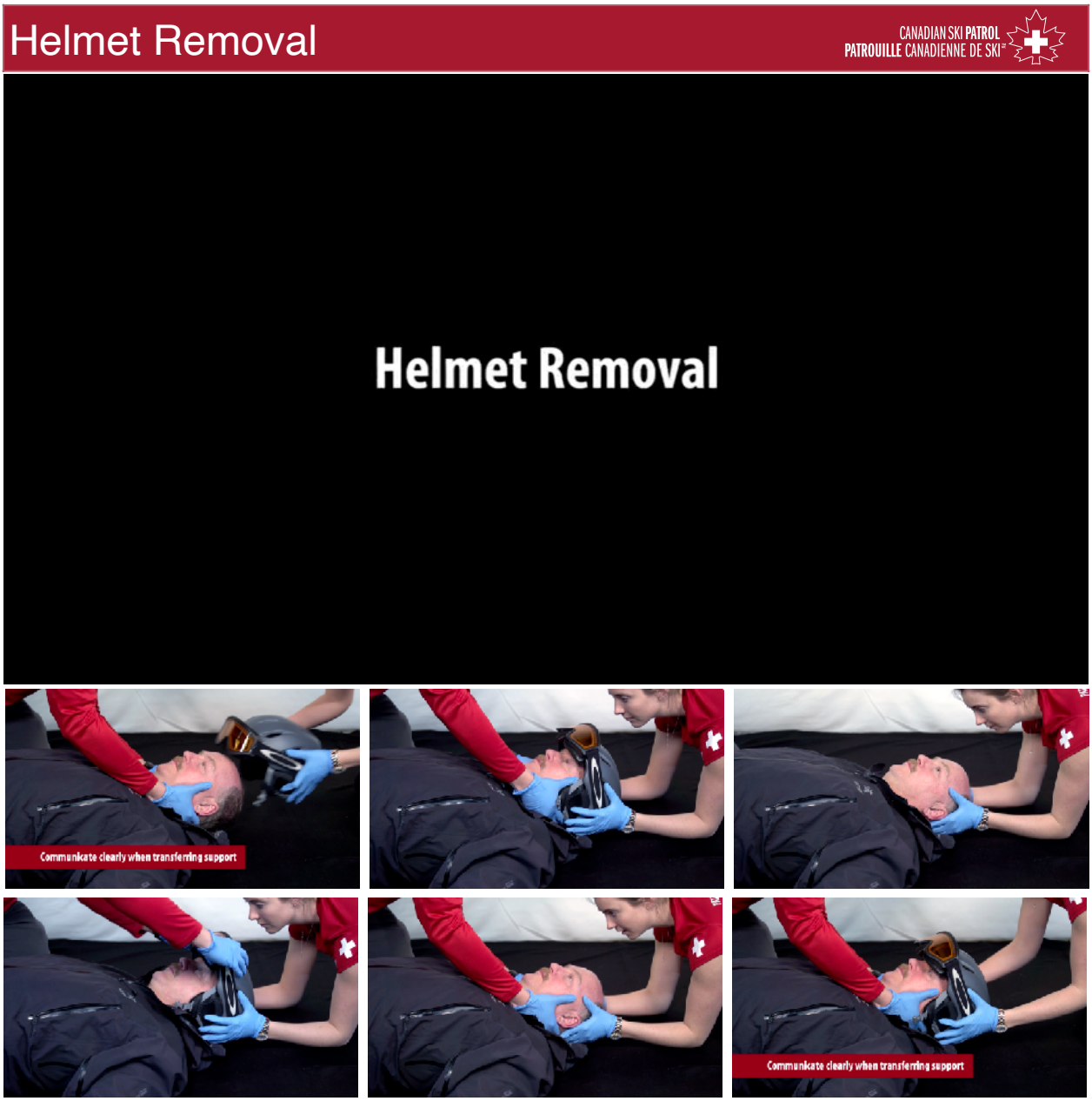

Figure 11-12: Helmet Removal

1. Decide whether or not the helmet needs to be removed. Ideally the patient should have been moved to a backboard or a vacuum mattress first; however, circumstances will define the feasibility of this.
2. Eye wear, chin straps and electronics should be removed before the helmet is removed.
3. Manual control of the head during the removal of the helmet is mandatory. There are two effective techniques that may be used:
   - hands over the clavicles, supporting the head on both sides along the jaw line and behind the ears, or
   - a fore-and-aft grip where one arm lies on the sternum with the hand supporting the head along the anterior jaw line and the other arm lying on the ground with the hand supporting the head under the occiput.

   Personal preference and situational peculiarities may favour one technique over the other
4. The patroller managing the head must be in a position to completely support the weight of the head once the helmet has been removed.
5. The patroller manoeuvring the helmet should hold the helmet by curling the fingers under the rim of the helmet at the point where the chin strap connects to the helmet. During the moving of the helmet off the head, some pull must be exerted outwards to alter the internal shape of the helmet, to help it clear the ears. This is more of an issue with hard shell, full-coverage helmets such as motorcycle helmets than for many of the ski helmets currently on the market.
6. Slide the helmet off the back of the head (occiput) before tilting it back to clear the nose. When viewed from the side, the helmet will trace an S pattern in the process of being removed.
7. Once the helmet is removed, the patient's head will be off the ground by at least the thickness of the helmet. The patroller removing the helmet then takes over manual control of the patient's head and with gentle in-line pull moves the patient's head/neck into neutral alignment (ear canal in line with the middle of the shoulder when viewed from side). If this cannot be achieved due to pain or physical obstruction, the space under the head must be taken up by firm padding. A cervical collar may be applied and the patient secured as per standard procedure.

Conclusion

Keep the following points in mind when dealing with spinal injuries:

- Support the patient's head in a neutral position. Make sure that the airway is kept clear.
- The goal is to prevent motion of the head in relation to the body. Securing both will also protect the neck.
- It is important to communicate with the patient at all times. The cooperative patient can provide assistance by not moving and providing verbal feedback to the patroller during the application and maintenance of SMR.
- A cervical collar is a reminder to the patient not to move and a visual cue of a possible c-spine injury.
- A cervical collar may not be advised when excess movement of the head or neck is required during application. This could be due to clothing or positioning.
- If at any point, the patient's level of consciousness deteriorates the situation becomes a Load and Go.

- Have enough patrollers to move the patient safely. The number of patrollers required depends on the size and shape of the patient and the situation.
- Any movement must be slow and steady with continual monitoring of the patient.
- Avoid any motion which produces spinal flexion or rotation. If the patient's legs must be straightened stabilize the body and apply steady axial stabilization between the head and hips before moving the legs.
- If possible, people injured in vehicles should be stabilized before they are removed. It is best to leave them in their vehicles until qualified help is available, unless priorities dictate otherwise.
- Place an unconscious patient so secretions can drain from the mouth by tilting the backboard sideways and supporting it with padding.
- Monitor a patient with a spinal injury continuously, and administer oxygen if required.

12. Wounds

Learning outcome:

Recognize, understand, and treat wounds.

Upon completion of this chapter you should be able to:

1. Describe the types of, and hazards associated with, superficial wounds and deep wounds.
2. List the signs, symptoms and treatment of infected wounds.
3. Demonstrate the general treatment of wounds.
4. Demonstrate the specific treatment of impaled objects and amputations.

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Wounds

A wound is an injury which damages the tissues, organs or bones of the body. It may be closed, like a contusion or hematoma, or open with the skin broken making the wound susceptible to infection. It may be superficial, a cut on the surface of the skin or a small bruise, or it may be deep, a cut exposing fat or muscle under the skin or a large bruise indicating damage to more than just surface tissue. Deep wounds usually involve notable bleeding, external or internal, and often require additional medical attention such as sutures.

In the presence of a wound, patrollers must take standard precaution to minimize exposure to infectious diseases for both themselves and the patient.

Types of open wounds

Abrasion

The skin, and possibly the tissues immediately below the surface, have been rubbed or scraped. Bleeding is generally easily controlled because only capillaries are affected. The patient may feel a great deal of pain because of the many nerve endings that are damaged and exposed.

Avulsion

A flap of skin is torn loose from the body. The flap may either remain hanging or be completely torn off. Avulsions may occur on any part of the body.

Laceration

A break in the skin. A cut. This wound may affect underlying structures depending on the depth. Lacerations may cause significant bleeding if the wall of a blood vessel is broken, particularly an artery.

Puncture wounds

A puncture wound is caused by a stab from a pointed object, such as a nail or ski pole. The opening in the skin may appear small, but the resulting wound could be very deep and could pose a serious infection problem. Internal organs can also be injured by this type of wound.

Impaled objects

An impaled object wound is a puncture wound with an embedded object. The object should be stabilized and left in the wound. Efforts to remove it could cause severe hemorrhage, nerve damage and additional injury to underlying structures.

Amputations

An amputation is the complete or partial severing of an extremity, such as a finger or a toe. It may be caused by a sharp object, such as a knife or wire, or by a squeezing action, such as between a lift cable and drive wheel. Amputations rarely bleed much unless the extremity is torn or crushed. The body's reaction is to vasoconstrict the blood vessels, which reduces hemorrhage in the case of a clean-cut amputation.

Hazards of wounds

Blood loss

After priorities have been dealt with, treat bleeding from all non-life-threatening wounds as soon as possible.

Estimate the amount of blood loss, keeping in mind the tendency to over-estimate.

This information will be useful to you and EMS if a patient begins to show signs of shock.

Loss of function and tissue damage

A major injury may cause immediate and possible long-term serious tissue damage and loss of function. Prevent further deterioration by taking action to stop any bleeding, splinting to prevent movement of major injuries and, if necessary, rapid transportation to advanced medical attention. This is particularly true where serious injuries may restrict the blood flow to parts beyond the injured site.

Infection

Infection is the growth of foreign bacteria. Any break in the skin carries the risk of infection, especially if it is exposed to foreign agents. The risk of infection varies with:

- the size of the injury
- the location of the injury
- the extent of external contamination
- the time between the occurrence of the injury and reaching proper medical aid

Contamination of the wound with dirt and soil introduces the risk of tetanus. Many other types of bacteria may be introduced. The incidence of infection can be reduced with the application of an antibiotic cream or ointment (if there are no known allergies to the antibiotic) if the wound is an abrasion or superficial. Cover the wound with a sterile dressing and refer to medical care as appropriate.

Signs and symptoms of infection :

- swelling
- redness
- tenderness
- heat
- pus which may indicate formation of an abscess

Treatment for infection

1. Leave the wound intact.
2. Cover with a sterile dressing.
3. Recommend the patient seek further medical aid.

Treatment of wounds

- prevent further complications
- control bleeding
- prevent infection

Procedure

1. Examine for foreign material in the wound.

2. Remove any loose material and flush with clean water, preferably tap water because of the benefit of water pressure to assist in cleaning the wound. If necessary, use a clean (sterile) gauze to gently remove debris while irrigating. Do not scrub vigorously, as this can cause more tissue damage.
3. If the wound is an abrasion or a superficial wound, check if the patient has any known allergies to the antibiotic. If the patient has no known allergy, apply an antibiotic cream or ointment to the wound. When administering antibiotic ointments or creams, use an intermediate device (e.g. cotton tips) between any multi-use container and the patient or administer using single-dose packages (preferred).
4. Place a sterile, non-adherent dressing over the entire wound.
   - If this is not possible, use a clean, dry dressing, triangular bandage or some suitable cloth.
   - Never use cotton batting as a dressing.
5. Apply direct pressure to any continuous bleeding.
   - Use a bandage or tape to hold the dressing in place. Use a pressure bandage where bleeding continues.
   - Always check for PMS distal to the wound before and after bandaging (see Pulse, motor response and sensation in Chapter 4).
6. Elevate injury site.
7. Splint if necessary to keep the wound from moving and disrupting the clotting process.
8. Watch for signs of shock.
9. Monitor vital signs.
10. Recommend the patient seek further medical aid for any deep or significant wound.

Impaled objects

1. Control hemorrhage by applying pressure around the object but not on the impaled object itself.
2. Stabilize the impaled object with bulky dressings all around the wound site.
3. Unless the object is extremely unwieldy, do not attempt to shorten it. Movement may further damage nerves, blood vessels, and surrounding tissues.
4. Monitor for shock, activate EMS and transport to medical aid.

Figure 12-1: Impaled objects.

Amputations

Treatment of the patient

- control bleeding by applying direct pressure to the injury site, or a tourniquet proximal to the amputation if deemed necessary, and elevating it as soon as possible
- splint the area if it is possible that it may be fractured
- treat the patient for shock
- monitor the patient's vital signs
- activate EMS and transport to medical aid

Treatment of the severed part

1. Wrap the severed part in a sterile dressing.
2. Place the severed part in a sealed plastic bag to keep it dry.
3. Place the sealed plastic bag in cold water.
4. Transport the severed part with the patient.
5. Record date and time of amputation.

Chafing

Chafing is caused by repeated motion - specifically, skin rubbing against loose fabric or other skin. It most often occurs around the bra line (women), nipples (men), inner thighs, and under the arms. Moisture, either from sweat or rain, can worsen chafing.

Signs and symptoms of chafing:

- tender, red and raw skin
- painful stinging or burning sensation
- bleeding

Treatment for chafing:

If the skin is not broken, suggest the use of a lubricant such as petroleum jelly or Runner's Lube. A tongue depressor should be used to apply the lubricant to the wound.

If the skin is broken, treat the area like an open wound and cover the chafed area.

If the bandage or tape will not adhere to the skin due to sweat or sunscreen, use a semi-permeable dressing such as Hypafix.

Friction blisters

When it comes to minor friction blisters, generally no treatment is required other than a protective cover. Most blisters typically heal on their own in just a few days. Small unbroken blisters that don't cause discomfort can be left alone to heal. The best protection against infection is a blister's own skin.

With continued friction, blisters can be painful and become infected.

If you suspect a blister has been caused by a burn, refer to the section on burns (see Burns in Chapter 17).

Always look for signs of existing infection first. These include pus drainage, red or warm skin surrounding the blister, or red streaks leading away from the blister. If present, apply a protective dressing and refer the patient to medical aid.

Treatment for undrained blisters

1. Clean the blister site with saline or anti-bacterial cleanser.
2. If there are no signs of infection, apply an appropriate bandage/cover to protect the blister.
3. For continued activity, apply 2nd skin over the blister and then cover it with moleskin or appropriate adhesive covering (such as Hypafix). This will prevent additional friction.

Treatment for open blisters

Treat open blisters as you would an open wound. Lancing or draining intact blisters may expose the dermis to bacteria and should not be performed in the field.

For information only

[A CSP Regular Member (Advanced First Aid (AFA) certified) is not trained in these procedures]

Some treating practitioners will aspirate or lance a very large blister using a sterile technique but those in the field with basic medical supplies should avoid contaminating an intact blister. At times this lancing is done to convert a non-ambulatory foot to an ambulatory one for the purposes of self-evacuation.

In the more extended time period beyond first aid, it may be necessary to identify and consider draining a blister showing signs of infection.

Splinter removal

A splinter is a sharp fragment of organic or man-made material that becomes embedded just below the top layer of the skin. Splinters can become infected if left under the skin. The chance of a splinter becoming infected depends on what the splinter is. Organic material such as animal spines or plant thorns is more likely to cause infection or toxic reactions.

Signs and symptoms of splinters:

- redness
- swelling
- Pus draining from the wound
- Severe pain even without movement

Look for signs of infection before trying to remove a splinter.

If the splinter has become infected, is deeply embedded, or close to the eye, do not attempt to remove it. Cover the wound and recommend the patient seek additional medical aid.

Treatment for splinters:

1. Clean the wound and entire wound area thoroughly with saline or antibacterial cleanser.
2. Before trying more invasive methods, gently squeeze the splinter from both sides and the bottom to try and work it back the way it came.
3. If the splinter is under the skin or hard to grab: use a sterile packaged pin or needle (or Splinter Out). Gently remove skin over the splinter.
4. Use tweezers to grab the splinter. Carefully pull it out at the same angle it went in.
5. Once the splinter is out, clean the wound again.
6. Pat dry, and cover the wound to protect against infection.

If the patient is hesitant to allow the removal, treat as a minor wound, cover with additional padding. An updated tetanus shot may be advisable.

Dental injuries

A blow to the mouth area may cause teeth to pop out of the gum or fracture. In some cases, broken permanent teeth can be saved if proper care is taken.

Do not attempt to re-implant the tooth yourself. The avulsed tooth should be held at the crown, not the root. The crown of a tooth is the area that sits above the gum.

Due to the nature and location of tooth injuries, examine the patient for signs and symptoms of head, neck or spine injury and address these accordingly.

If a sensitive dental nerve is exposed, and the patient is alert, have them cover it with gauze to protect it from cold air.

Do not clean the avulsed tooth, as this could damage vital tissues still attached to the tooth.

It is preferable that the avulsed tooth is temporarily stored in one of the following media to aid in survival of the tooth before re-implantation, subject to availability and in order of preference and subject to local regulations:

- Hanks' balanced salt solution
- Propolis (10%, 50% or 100%)
- oral rehydration salt solutions, including Ricetral
- cling film (plastic wrap)
- cow's milk (any percentage fat, pasteurized or homogenized)
- saliva (never store the tooth in the patient's mouth)
- saline
- tap water

Recommend the patient seek further medical aid from a dentist as soon as possible. When possible, an avulsed tooth should be re-implanted by an oral surgeon within 30 minutes.

Contusions

Contusions (bruises) are dark discoloured areas on the skin that form when blood seeps into the surrounding tissue beneath the skin. Bruises do not always occur at the exact site of the trauma as gravity can cause them to appear in another location.

Contusions should be treated using the acronym RICE – rest, ice, compression, elevation (see Treatment under Tendon injuries).

Bleeding from specific sites

Open fractures

See Open fractures in chapter 13.

Nose

Nose bleeds are common and occur for a variety of reasons which differ in patients of all ages. The vast majority will respond promptly to treatment.

Patients who bleed heavily in spite of treatment should be referred to medical aid.

Treatment

1. Have the patient sit so that his head is bent slightly forward. Do not tilt the head backward.
2. Have the patient pinch their nostrils together. Apply pressure for five to 10 minutes.
3. Loosen any constrictions around the neck.
4. Caution the patient to avoid swallowing blood for it could cause nausea or vomiting. Have them spit the blood out after it gathers in the mouth.
5. Caution the patient to avoid sniffing or blowing their nose during and after the bleeding.
6. If bleeding continues, apply an ice cube or cold compress over the nose.

In all cases where you observe fluid or blood coming from a nose, inform medical authorities in a note attached to the patient stating quantity, duration, and colour.

Ear

Blood, clear fluid, or a mixture of both, coming from the inside of the ear may be evidence of a suspected fracture of the base of the skull.

If you suspect a head, neck or spine injury, treat as such. If you do not, do the following:

1. Cover the ear with a sterile or clean dressing.
2. If other injuries permit, position the injured person in the recovery position with the affected ear down so that fluid can drain from the ear.
3. Caution the patient to avoid blowing their nose.
4. Recommend the patient seek further medical aid.

Face and scalp

Bleeding from the face and scalp often appears worse than it really is. However, face and scalp bleeding may be serious enough to have significant blood loss. Note that the scalp is very vascularized and even a small laceration will bleed a lot. Treat this type of bleeding like other cases.

When treating bleeding from the face and scalp, though, be careful not to depress a possible underlying fracture. This danger is remote except when the skull is severely fractured and is no longer rigid. In these cases, common sense dictates that only light pressure be applied.

Always consider the possibility of an associated neck injury.

1. Examine carefully for signs of skull fracture and head or spine injury. If found, treat as such. If these injuries can be ruled out, then continue.
2. Apply sterile or clean dressings to the wound and bandage the wound securely in place.
3. Apply sufficient pressure to stop bleeding without causing unnecessary pain.
4. Monitor vital signs.
5. Recommend the patient seek further medical aid.

Mouth or tongue

Bleeding from the mouth or tongue is easy to diagnose, but may be difficult to treat in the case of a small patient, such as a child.

1. Examine carefully for signs of neck, head or spine injury. If found, treat as such. If these injuries can be ruled out, then continue.
2. If the injury is inside the mouth between the teeth and lips and the patient is conscious, have them hold a gauze pad against the wound.
3. Position the head so that blood does not flow into the esophagus and trachea. Elevate the head and position it forward only if a neck injury is not suspected.
4. Apply sterile gauze padding if bleeding is a result of teeth being knocked out.
5. Recommend the patient seek further medical aid.

Neck

Lacerations of the neck may involve a severed artery.

Treatment for lacerations if a major artery is involved

1. Place your fingers both above and below the wound using both hands.
2. Push the artery toward the back of the neck using your fingers. **Do not apply pressure sideways.** Sideways pressure may constrict the airway.
3. Treat as a Load and Go.
4. Activate the EMS.
5. Maintain constant pressure throughout transport.

Treatment for lacerations if a major artery is not involved

1. Cover with sterile gauze.
2. Bandage lightly.
3. Transport to medical aid.

Varicose vein ulcer

People of all ages may suffer from advanced varicose veins on their legs which may bleed profusely, either spontaneously or as a result of trauma.

1. Lay the patient down and remove any constricting garments or clothing from around the leg.
2. Raise the leg as high as possible to reduce the blood flow in the veins.
3. Apply a sterile dressing to the wound and a suitable bandage to hold pressure on the injury. Monitor the patient.
4. Transport to medical aid.

Bites

All breaks in the skin caused by animal or human bites require immediate medical attention because of the probability of infection.

1. Apply a dry sterile dressing.
2. Recommend the patient seek further medical aid.

Evisceration

A massive laceration of the abdominal wall may result in the extrusion of intestines through the opening.

1. Do not replace the intestines inside the body.

2. Cover the intestines with a warm, moist, sterile or clean cloth. Hold the cloth in place with broad triangular bandages. Use as many as required.
3. Administer high-flow oxygen.
4. Transport the patient in the supine position with their knees and upper torso slightly elevated.
5. Monitor the vital signs carefully.
6. Give nothing by mouth.
7. Treat for shock, activate EMS and treat as a Load and Go.

Conclusion

Wounds are a visible evidence of injury. Persons with wounds that develop redness, warmth or become painful; or persons with wounds who develop fever should seek medical attention. Complications such as ruptured blood vessels and severed nerves are of immediate danger to the patient. Significant wounds should receive immediate medical attention because of the dangers of infection and loss of a large amount of blood. If blood loss is significant, monitor the patient's vital signs, treat for shock and always consider activating EMS and treating as a Load and Go.

13. Dressings, bandages and slings

Learning outcome:

Recognize, understand, and apply dressings and bandages for the treatment of injuries.

Upon completion of this chapter you should be able to:

1. Apply appropriate types of dressings, bandages and slings to corresponding injuries.
2. Explain the basic principles of bandaging.

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Dressings

A dressing is the material placed next to a wound to absorb and stop blood or other fluid loss.

- sterile dressing (commercially available)
- non-sterile dressings (that may be improvised dressings under the circumstances)

Dressings are held in place with tape, a bandage or gauze.

Sterile dressings

Sterile dressings are applied directly to a wound. They are available in various sizes (four-by-four or three-by-three inches) and thicknesses. Large and bulky dressings are known as abdominal pads, sometimes known as ABD pads. Manufacturers supply these sterile dressings sealed in paper.

Dressings with a non-stick outer layer are preferable as they will not stick to the wound when being removed.

Sterile dressings are only sterile if the wrappings are kept sealed, intact and dry. Sterile dressings help prevent the introduction of bacteria into the wound and provide protection against further injury.

When applied to an actively bleeding site, use a non-adherent dressing (Telfa, or similar) to place directly on the wound to prevent gauze becoming adherent to the wound because of clotting. Adherent dressings such as gauze can be used as reinforcement, or to clean an injury before the more permanent non-adherent dressing is applied.

Non-sterile/improvised dressings

If it is the cleanest-available covering and you can avoid contamination by handling, you can improvise a dressing from such things as:

- the inside of a clean, ironed, folded handkerchief
- a freshly-laundered towel
- a linen washcloth
- a pillow case
- a bed sheet

Avoid using wool and cotton batten, since their easily dislodged fibres can contaminate the wound.

Bandages

A bandage is a wrapping used to secure the dressing onto the wound. Some bandages are manufactured with dressings attached (e.g. Band-Aids). Bandages are made from cloth, elastic, adhesive and gauze materials. They should be as clean as possible.

Use bandages to:

- secure splints or to hold a dressings in place
- protect an injured area
- exert pressure on an injured area
- give support to a part of the body
- limit movement of a part of the body in place of a splint

When properly applied, bandages promote healing, prevent complications and provide comfort to the patient during transportation.

Basic principles of bandaging

A bandage:

- should not be applied so tightly that it restricts circulation or so loosely that it allows a dressing to slip. It is important that a bandage be properly placed and well secured
- must be tight enough to control hemorrhage or stabilize the wound without constricting circulation to any parts distal to the injury
- must be applied so that pressure to the wound is evenly distributed
- must cover the entire sterile dressing

Where possible, leave the fingers or toes of the bandaged extremity exposed enabling you to recheck distal PMS (see Pulse, motor response and sensation in Chapter 4).

Knots must be accessible.

Place padding between the knots and the body. This will minimize possible pressure and sores.

Never use encircling roller bandages underneath a splint; they may impair circulation.

Signs and symptoms that a bandage is too tight are:

- skin distal to the bandage becomes pale or cyanotic (bluish)
- patient complains of pain usually only a few minutes after the bandage has been applied
- skin distal to the bandage may be cold
- skin distal to the bandage may be tingling and numb

Bandage usage

Triangular bandages are very useful in the treatment of large areas of burns, weeping abrasion where it is beneficial to avoid pressure of other types of bandage applications.

Triangular bandages and slings

Triangular bandages are made from strong cotton cloth that is usually unbleached. A 100-cm by 100-cm (40-inch by 40-inch) square, cut diagonally from corner to corner, makes two triangular bandages.

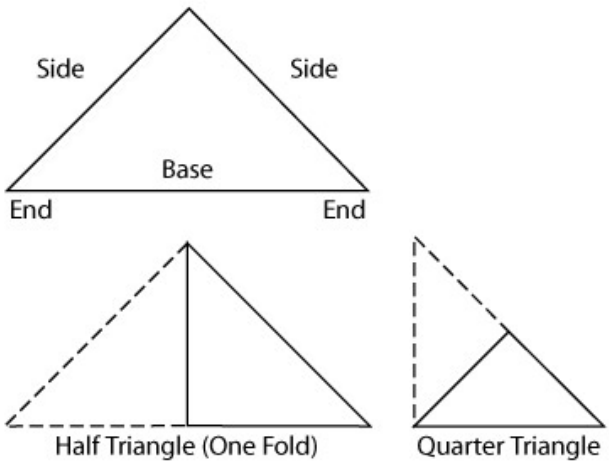

Figure 13-1: Triangular bandage configuration.

Triangular bandages are used to:

- support injuries (slings)
- cover joint injuries (elbow, knee, shoulder)
- cover large or rounded surfaces (torso, head, hips, foot, hand)

Folded triangular bandages

Triangular bandages may be folded as required. For example the half triangle and quarter triangle may be used for the application of slings and bandages on small children. Use this type of folded bandage to pad injuries, or when placing bandages in storage (e.g. stacked in a first aid cabinet or packed in a first aid kit).

Common examples of folded triangular bandages are:

- broad bandage
- cravat bandage
- roll cylinder bandage
- ring pad
- padding, or storage, bandage

Folding bandages for padding or storage

1. Begin with triangular bandage unfolded.
2. Fold the bandage in half, the tip of the triangle remaining exposed.
3. Fold in half a second time to make a broad bandage.
4. Fold in half a third time to make a cravat bandage.
5. Fold the ends of the cravat to the centre.
6. Fold the ends to the centre a second time.
7. Fold the bandage in half.
8. Make sure the point of the bandage remains visible. This is the most efficient method of folding.

Folding bandages

Figure 13-2: Folding a triangular bandage.

To unfold a triangular bandage for use:

Grip the protruding point and shake the bandage. The bandage will open quickly and efficiently. In many instances you will only have one hand free to open a bandage.

To unfold the bandage for use as a cravat:

Grasp the middle and shake.

To open the bandage for use as a broad bandage:

1. Grasp the middle and shake. This forms a cravat bandage
2. Open the cravat.

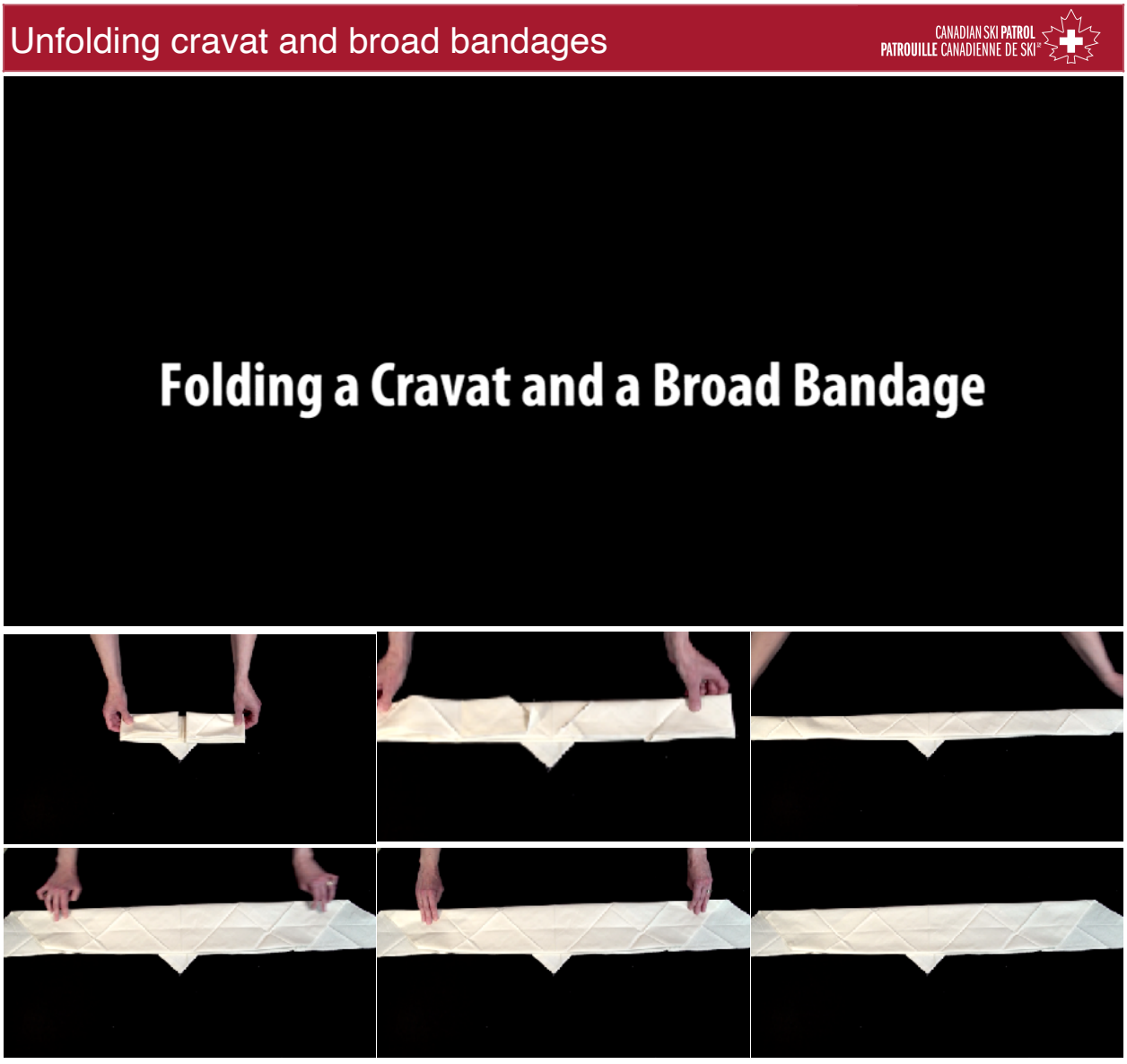
Unfolding cravat and broad bandages
CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI
Folding a Cravat and a Broad Bandage

Figure 13-3: Unfolding a triangular bandage.

Cravat bandage

Cravat bandages are used for securing splints and tying to a backboard as detailed below:

- wrap
- tie over areas for increased pressure
- tie for stabilization
- provide belt-like support

Broad bandage

Broad bandages are often used as transportation bandages and are used to:

- wrap
- tie over regions that require a wide area of support
- serve as a sling

Roll cylinder

Use roll cylinders (gauze) to pad or make large circle pads. The roll cylinder can also be used as a soft collar when a stiff-neck collar cannot be applied.

1. Unfold a triangular bandage and place three or four folded cravat bandages across the midportion.
2. Fold the apex of the unfolded cravat to the base, and then roll the midportion with the folded cravat bandages towards the base to complete the roll cylinder.

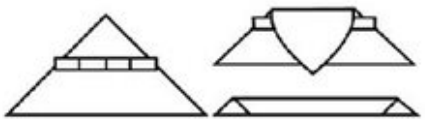

Figure 13-4: Roll Cylinder

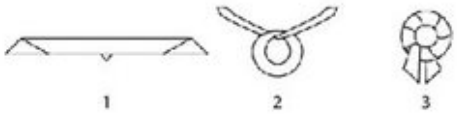

Figure 13-5: Ring Pad

Ring pad

Use a ring pad to pad and elevate the bandage above the injury, such as might be used to protect a protruding compound fracture.

1. Pass one end of a cravat bandage once or twice around the fingers.
2. Bring the other end of the bandage through the loop thus formed.
3. Continue to pass it around again and again until you use the entire bandage and have formed a firm ring.

In an urgent situation, wrap a cravat bandage around your hand to make a ring pad.

Open or close your fingers, according to the size of the ring required.

Roller bandages

Rolls of form-fitting, non-elastic, self-adhering bandages are available in various widths. You may secure roller bandages easily with overlapping wraps, which may then be cut and tied, or held in place with adhesive. Use gauze strips (e.g. Band-Aids) for smaller wounds. These

should also be kept in their sealed paper covers. When applying bandages, take care not to restrict circulation.

Improvised bandages

Such common items as belts, scarves, sweaters, shirts and jackets can all be used as bandages.

Pressure bandage

Use the pressure bandage to control severe bleeding. When applying a pressure bandage to control severe bleeding, use one hand. Keep your other hand on the wound to apply direct pressure.

When applying this bandage, do not move the injured limb needlessly until an examination of the injured area is completed. If there are no other injuries to the area, elevate the limb and support it as much as possible.

1. Open the folded triangular into a cravat and place a dry pad and a sterile dressing in the middle of it. The pad distributes the pressure increasing the effectiveness of the bandage.
2. Apply the cravat, pad and sterile dressing to the wound as a unit, as the other hand is removed.
3. Wrap both ends around the limb and tie them directly over the dressing.

Figure 13-6: Pressure bandage.

Pressure bandage for the hand

Use this type of bandage to control severe bleeding from the palm of the hand. The purpose of this bandage is to apply pressure on the cut, as opposed to closing the wound. This bandage should be used to control severe bleeding regardless of the direction of the wound.

1. Place a sterile dressing over the wound and add a small pad on top of the sterile dressing about the size of a folded triangular bandage.
2. Have the patient grasp the pad firmly with the thumb exposed, if possible.
3. Hang a cravat over the wrist.
4. Take the thumb side end around and over the knuckles.
5. Carry the end back to its starting point at the wrist.
6. Take the other end around and over the knuckles, leaving the thumb exposed.
7. Cross ends under wrist.

8. Snug up both ends to apply pressure.
9. Tie a reef knot over the closed fingers spreading the bandage so that it pulls the fingers in towards the palm of the hand. Do not cut off the circulation to the hand.
10. Recheck distal pulse, motor response and sensation (but not at the thumb if it is not distal to the wound).
11. Place the arm in a body sling for elevation.

Figure 13-7: Pressure bandage for the hand.

Tourniquet

A tourniquet is a band or belt around the limb used to constrict blood vessels to control the flow of blood from a severely bleeding wound. In the recent past, it was considered a last resort for controlling bleeding. Tourniquet use has increased in light of recent military actions and its effectiveness at preventing loss of life due to extremity blood loss is well proven.

Situations which may necessitate the use of a tourniquet:

- multiple injury sites on the same limb
- penetrating trauma from firearms and stabbings
- multiple casualty incidents where resources are limited
- injuries in remote areas where resources are limited and transportation to definitive care may be delayed
- industrial or farm incidents

There are several tourniquet devices in the commercial market. These devices may be used by CSP patrollers following the manufacturer's recommendations for application.

In the absence of a commercial device, one or two triangular bandages (depending on the size of the limb and the size of the bandages) and an improvised rod or bar to use as a windlass for twisting will work well.

Tourniquet

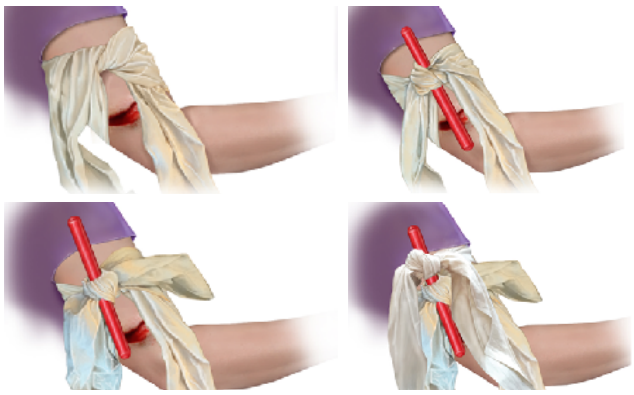

Figure 13-8: Tourniquet fashioned from materials at hand.

Applying a tourniquet

4. Apply a broad bandage around the limb and against the skin, close to and above the injury site (about 10 cm or 4 inches, if possible). Do not apply over a joint. Tie the bandage tightly using an overhand knot.
5. Tie in the rod over top of the first knot, using a reef knot.
6. Apply pressure to the limb by twisting the windlass until blood flow ceases to flow from the injury site. Note: The application of a tourniquet is very painful to the patient.
7. Secure the windlass in place so that the initial pressure applied to the limb does not release. This can be done with a second bandage, a belt, or the tail ends of the first bandage.
   - Have someone hold the windlass in place while it is being secured.
   - Wrap the bandage or belt around the windlass to prevent slippage.

- Continue to wrap the bandage around the limb then secure in place with a knot on top of the windlass.

8. Write the time the tourniquet was applied on the tourniquet and on patient's skin close to the injury site so it is visible. (eg. TQ-13:45). = tourniquet applied at 1:45 pm.

Bandage for the forehead

Use this type of bandage to secure a sterile dressing on a specific wound. This method applies to injuries to the forehead, the temples, and the back of the head.

1. Apply a sterile dressing over the wound and a folded cravat bandage to hold it in place.
2. Place the centre of a cravat bandage over the dressing on the injury.
3. Wrap the ends around the head, crossing at the back.
4. Tie the ends lightly on the forehead without causing unnecessary pressure.

Bandage for the forehead

Figure. 13-9 : Bandage for the forehead

Bandage for the eye

1. If one eye is injured, cover it with a sterile dressing and a folded cravat bandage.
2. Leave the other eye uncovered so the patient can see.
3. Place the centre of a cravat bandage over the dressing.
4. Wrap the ends around the head, crossing at the back.
5. Do not tie the knot over the eye, tie the knot over the forehead.

Bandage for the eye

Figure. 13-10 : Bandage for the eye

Bandage for ear or cheek

Use this type of bandage to secure a sterile dressing on a wound to the side of the face (e.g. ear or cheek).

1. Place the centre of a cravat bandage over the dressing.
2. Carry the ends around the head, crossing them on the opposite side of the head.
3. Tie the ends firmly over the dressing. Do not obstruct the airway.

Sometimes wounds to the cheek area are best treated by having the patient apply direct pressure themselves.

Bandage for the head

Use the bandage for the head to retain large sterile dressings in position on the top of the head, when the scalp is lacerated.

1. Cover the wound with a sterile dressing.
2. Use an unfolded, fluffed-up triangular or other suitable padding over the sterile dressing to help stabilize it.
3. Fold a narrow hem along the base of the open triangular bandage.
4. Place the centre of the base immediately above the eyebrows.
5. Bring the ends to the back of the head covering the ears and cross them under the slight bulge at the back of the head.
6. Carry the ends around the head and tie on the forehead over the centre of the bandage.
7. Pull down the point of the bandage snugly.
8. Fold the point over the crossed ends and pin it above the cross-over at the back of the head.

Ensure that the bandage does not obstruct the patient's view.

Bandage for the head

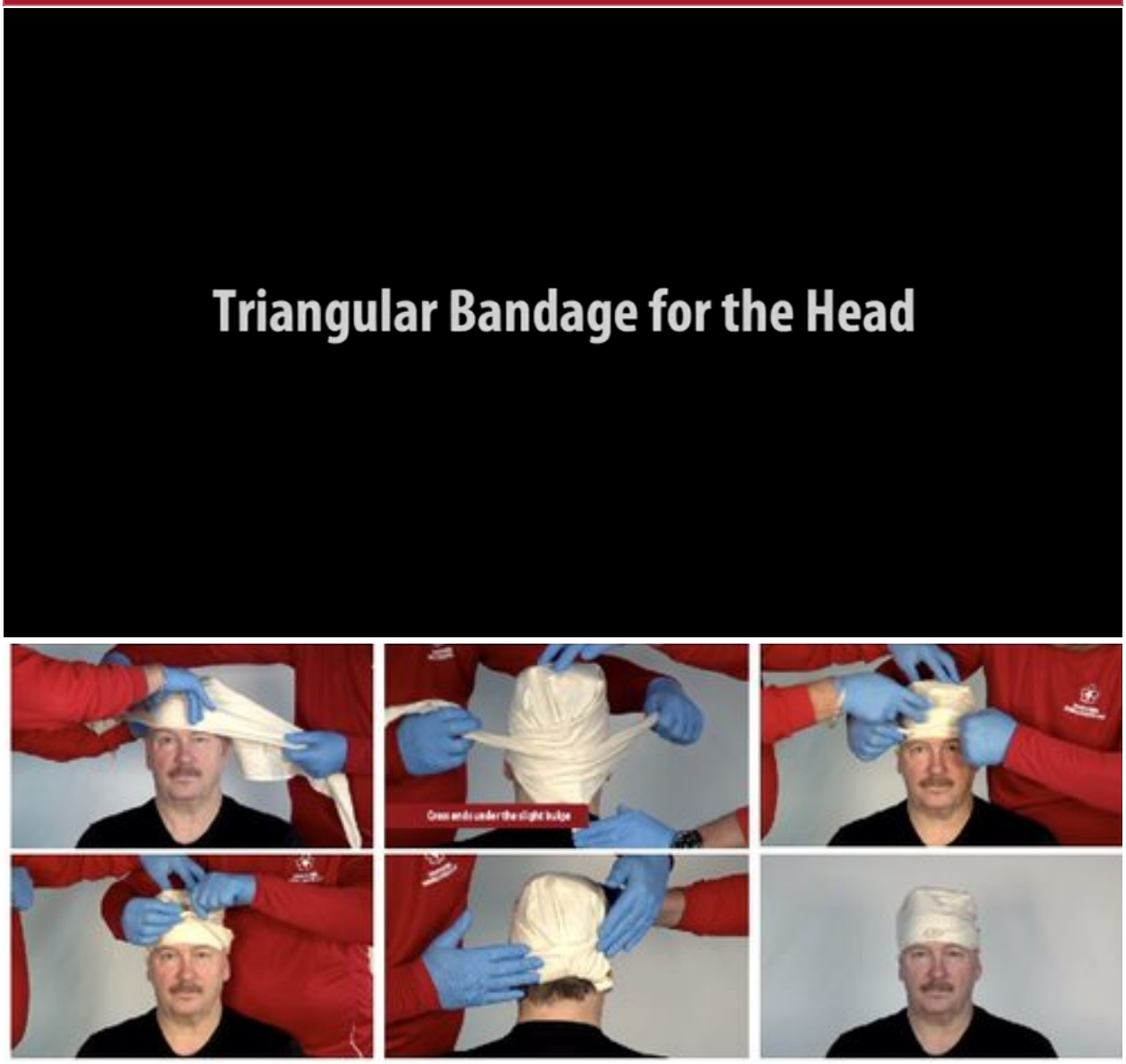

Figure. 13-11 : Bandage for the head

Bandage for the shoulder

Use the bandage for the shoulder to retain a large dressing on the shoulder. After bandaging, place the arm at rest and secure using a small arm sling.

1. Apply a sterile dressing and a fluffed-up triangular to help hold it in place.
2. Place an open triangular bandage over the dressing with the point toward the ear.
3. Fold a hem along the base of the bandage.
4. Cross the ends on the inside of the upper arm, then tie the ends on the outside of the arm.
5. Place the arm in a small arm sling.
6. Pass the point of the triangular bandage under the knot of the sling.

7. Carry the point over the dressing and pin it in position.
8. Recheck distal pulse, motor response and sensation.

Figure 13-12: Triangular bandage for the shoulder.

Bandage for the hip

Use the triangular bandage for the hip to retain a dressing on the hip. This bandage is applied similarly to the shoulder bandage.

9. Tape any sterile dressing in position, if required.
10. Use an unfolded, fluffed-up triangular over the gauze to assist stabilizing it, once the bandage is applied.
11. Place an open triangular bandage over the dressing with the point to the waist.
12. Fold a hem at the base of the bandage.
13. Cross the ends on the inside of the thigh, then tie the ends on the outside of the thigh.
14. If the patient is not wearing a belt, form one around the waist with a cravat bandage.
15. Tie the knot on the injured side.
16. Tuck the point of the triangular bandage under this knot.
17. Fold the point of the open bandage over the knot of the "belt" and pin it in position.

Bandage for the chest and back

Use this type of bandage to hold a dressing in place on the chest or back.

1. Tape any sterile dressing in position, if required.
2. Use an unfolded, fluffed-up triangular over the gauze to assist stabilizing it, once the bandage is applied.
3. Place the point of the triangular bandage over one shoulder allowing the open bandage to hang over the chest or back.
4. Carry the ends around the trunk of the body, tying them so the knot is located below the shoulder on which the point is resting.
5. There will be one long end after the knot is tied.
6. Carry the long end up to the shoulder and tie it to the point of the bandage.

Make sure the bandage does not restrict breathing.

Bandage for the chest and back

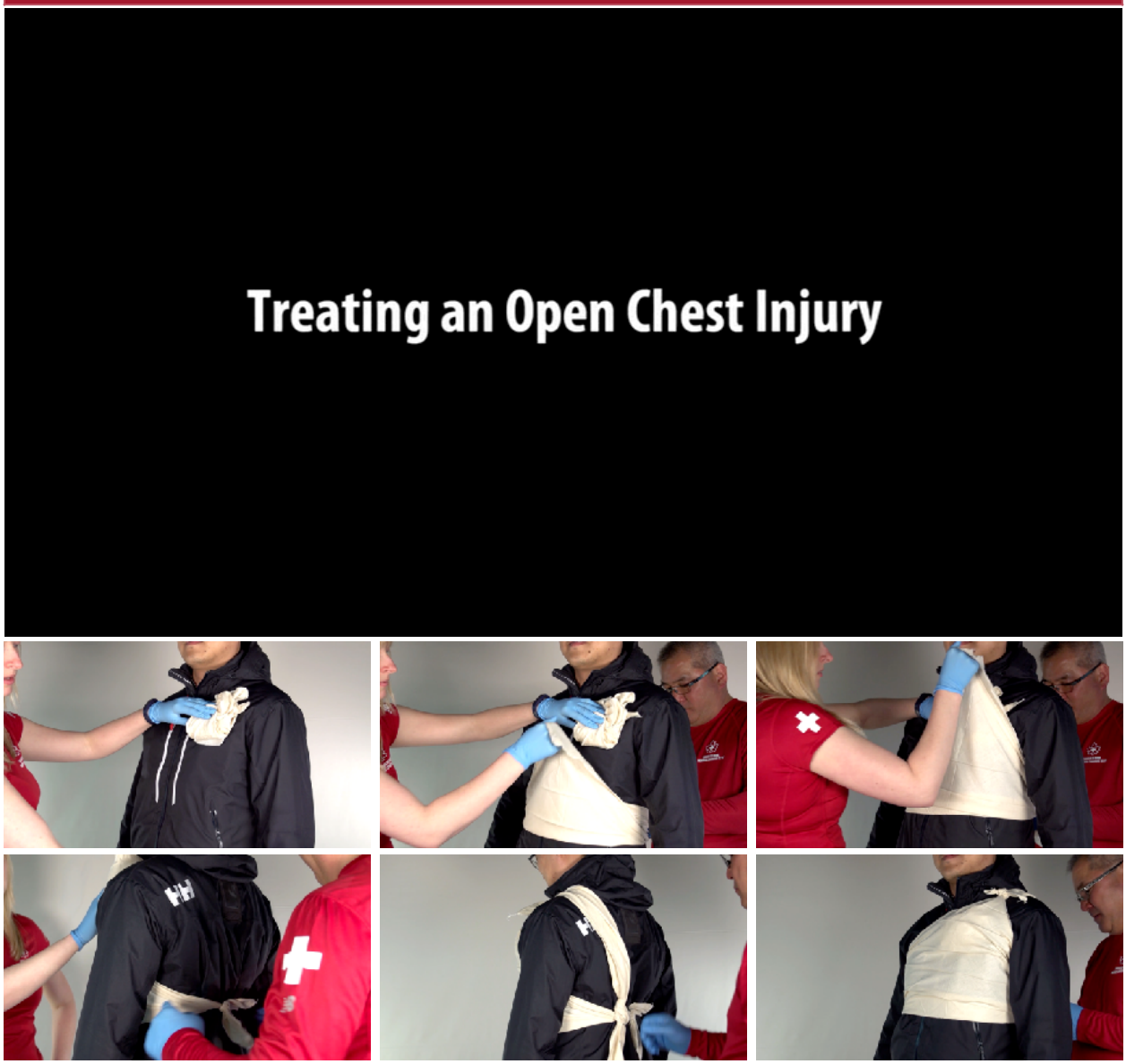

Figure 13-13: Bandage for the chest or back (assume the black jacket is the skin itself).

Bandage for the elbow and knee

Applying a bandage to the elbow

1. Tape any sterile dressing in position, if required.
2. Use an unfolded, fluffed-up triangular over the gauze to assist stabilizing it, once the bandage is applied.
3. Fold the two ends of an open triangular bandage together, making a half-size triangular. A full-size bandage is usually not necessary to cover the elbow.
4. Bend the injured elbow slightly and, with the sterile dressing in position, place the point of the bandage to the back of the arm above the elbow.
5. Carry the ends around the forearm, cross in the fold of the elbow, and carry to the back of the arm above the elbow.
6. Tie the ends together.
7. Fold the point down over the elbow and pin it in position.
8. Recheck distal pulse, motor response and sensation.

Applying a bandage to the knee

1. Tape any sterile dressing in position, if required.
2. Use an unfolded, fluffed-up triangular over the gauze to assist stabilizing it, once the bandage is applied.
3. Place the open triangular bandage over the knee with the point toward the upper part of the thigh.
4. Fold a narrow hem along the base of the bandage.
5. Carry the ends around the leg, below the knee.
6. Cross the ends behind the knee and bring them up and around to tie on the lower part of the thigh.
7. Fold the point down over the knee and pin it in position.
8. Recheck distal pulse, motor response and sensation.

Bandage for elbow and knee

Figure 13-14: Triangular bandage for the elbow or knee.

Bandage for the hand or foot

Use this type of bandage to hold a dressing in place on the hand or foot. This bandage is not suitable to control a severely bleeding wound.

Do not use this bandage if you need to evaluate the distal pulse.

1. Tape any sterile dressing in position, if required.
2. Use an unfolded, fluffed-up triangular over the gauze to assist stabilizing it, once the bandage is applied.
3. Fold a narrow hem along the base of an open triangular bandage.

Applying bandage to the Hand

4. Place the hand in the middle of the bandage, palm side down so that the fingers are directed toward the point and the wrist is across the centre of the base.
5. Carry the point of the bandage over the hand and place it on the forearm.
6. Fold the sides in on either side of the hand.
7. Cross the ends over the hand, carrying them completely around the wrist and tie on top of the wrist.
8. Fold the point down over the knot and pin it in position.

Applying a bandage to the foot

4. Place the foot in the middle of an open triangular bandage with the toes directed toward the point and the heel about seven cm (three inches) from the base.
5. Carry the point over the foot to the front of the leg.
6. Fold the bandage in on either side of the foot.
7. Cross the ends over the foot, carrying them completely around the ankle.
8. Tie the ends on the front of the leg, just above the ankle.
9. Fold the point over the knot and pin it in position.

Figure 13-15: Triangular bandage to open hand or foot.

Cover bandage for open fracture

Use this type of bandage to cover an open fracture wound to avoid direct contact and pressure. A protruding bone or deformity at a fracture site may block or damage blood vessels, restricting the flow of blood to the extremity. All open fractures are contaminated with bacteria and are at risk of infection.

After cleaning off gross contamination, realign the limb and attempt to deliver the bone ends under the skin and in the soft tissue envelope. This is the best environment for the bone in pre-hospital care. Rapid administration of antibiotics is important to prevent infection. Communication to the transport crew of an open fracture speeds up the preparation of an intravenous line and antibiotics.

1. The wound can be irrigated, if saline is available.
2. Apply sterile dressings as required. If wound is dry, use moist dressings; if bleeding, use dry dressings.
3. Hold the dressings in place with tape or padding. (The padding will be secured in place by the completed bandage.)
4. Place a pad above and below the injury site.
5. Prepare two triangular bandages by folding a hem as necessary.
6. Place the two prepared triangular hems on the pads.
7. Pass the ends of the triangular bandages under and cross in the back.
8. Tie the bandages on the top as firmly as necessary.
9. Tuck the ends in and fold the points back over the knots.
10. Apply splint, as appropriate.(See Splints in Chapter 15)

Cover bandage for open fracture

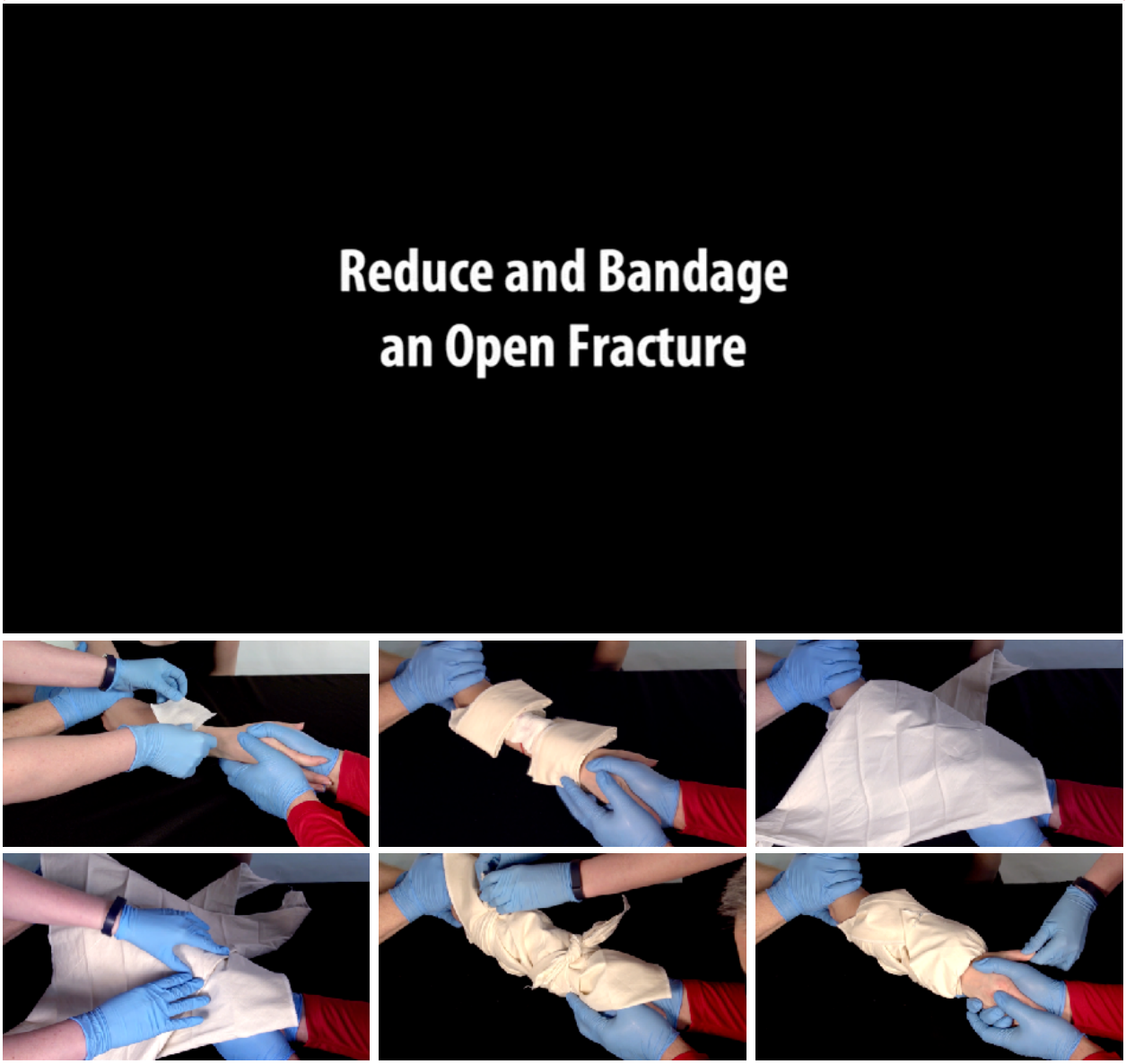

Figure 13-16 : Cover bandage for open fracture.

Stirrup bandage

Use this type of bandage to apply traction at the feet (see Splints in Chapter 15).

1. Tie two cravat bandages together.
2. Place the knot on the edge of the sole at one side of the boot.
3. Place the bandage under the sole and up the other side of the boot.
4. Have the patient hold the short end of the bandage.
5. Using the longer end, pass the bandage on top of the foot (in front of the ankle) and over the bandage held by the patient.
6. Pass the bandage behind the ankle (above the heel) and bringing it forward over the starting point in front of the ankle.
7. Insert the end under the loop in a direction from the foot toward the knee.
8. Fold down both ends of the bandage, away from the patient.
9. Position the loops on each side of the ankle so they are exactly in line with the centre of the lower leg. That is, the loops are neither toward the front nor the back of the ankle.
10. Using this bandage, hold traction (as illustrated).

When this bandage is applied there may be a tendency to elevate the leg inadvertently. The pull must be in line with the tibia and fibula.

Modified stirrup bandage

1. Fold two cravats in half.
2. Pass the folded end of one cravat under the patient's ankle(s).
3. Lay the other cravat over the top of the instep with the folded end on the opposite side. The points of each should point toward the feet.
4. Thread the tails of each cravat through the folds of the other cravat in a direction away from the feet, toward the patient's knees.
5. Gently pull on the tails to snug the bandages to the ankle, in line with the centre line of the leg (This minimizes the chance of rotation during traction).

Stirrup bandage

Figure 13-17: Stirrup bandage.

Small arm sling

Use the small arm sling for all upper arm injuries between the elbow and the shoulder in which the arm can be bent at the elbow. This sling permits gravity traction when required.

1. Place the injured arm across the body of the patient by holding onto their elbow and positioning the lower arm at 90 degrees to the patient's body.
2. Slide one end of a broad bandage up through the hollow that has been created at the patient's elbow.
3. Pass the top inside part of the bandage up and over the shoulder on the uninjured side around the neck and over the shoulder of the injured side.
4. Place the bandage so that the front edge covers the base of the little finger. The broad bandage should support the arm from the base of the fingers to above the wrist, to prevent the wrist from flexing.
5. Tie the two ends together with the knot located in the hollow just above the collar bone on the injured side.
6. Tuck in the loose ends when the sling is completed.
7. Pad under the knot for comfort.
8. Recheck distal pulse, motor response and sensation.

Small arm sling

Figure 13-18: Small arm sling.

Large arm sling

Use the large arm sling for all lower arm injuries from the elbow to the fingertips except in cases of severe bleeding. As above, this sling also is used for cases where the arm can be bent at the elbow.

1. Place the injured arm across the body of the patient by holding onto his elbow and positioning the lower arm at 90 degrees to the upper arm.
2. Open the bandage to a full triangle. Slide one end of the triangular up through the hollow that has been created at the patient's elbow. Make sure the point of the triangular bandage is directed toward the elbow.
3. Pass the top of the inside part of the bandage up and over the shoulder on the uninjured side around the neck and over the shoulder on the injured side.

4. Fold a hem along the inside of the base to strengthen it and work it gently toward the hand so that the front edge covers the tip of the little finger.
5. Tie the two ends together with the knot located in the hollow just above the collar on the injured side.
6. Tuck in the loose ends.
7. Pull the point snug and pin or tie in front of the sling. Throughout the procedure the injured arm should be supported either by the patient or an assistant.
8. Pad under the knots for comfort.
9. Recheck distal pulse, motor response and sensation.

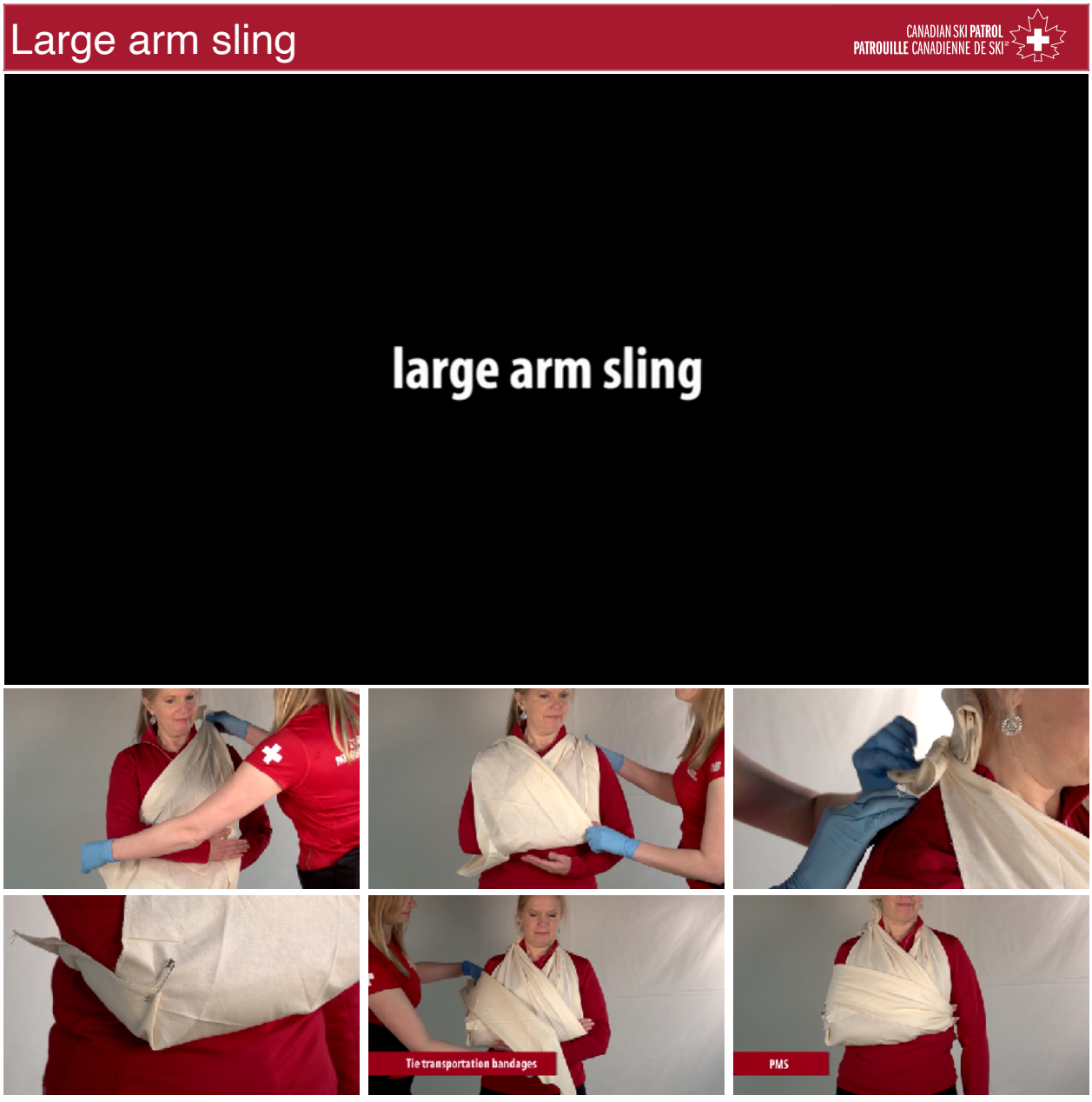

Figure 13-19: Large arm sling.

Body sling

Use the body sling to elevate the wrist or hand, especially in the case of severe bleeding.

1. Holding onto the elbow and moving the hand, place the forearm diagonally across the chest with the fingers pointing toward the opposite shoulder, close to the collarbone.
2. Place a triangular bandage under the injured arm with the long side parallel to, and even with, the forearm. Position the bandage with a short end at the shoulder and a long end at the elbow. Ask the patient to hold the bandage in place against their chest.
3. Bring the point of the bandage forward towards the elbow so that a pocket is formed around the arm.
4. Twist the long end and point of the triangular tightly together, then wrap around the back, towards the shoulder.
5. Tie the two ends together in the hollow just above the collar bone on the uninjured side. The arm should be supported in a well formed pocket.
6. Pad under the knot for comfort.
7. Recheck distal pulse, motor response and sensation. Blood circulation may be impaired at the elbow or under the upper arm.

Figure 13-20: Body sling.

When using the body sling, keep the thumb exposed and frequently check the radial pulse and skin colour and warmth.

Conclusion

Dressings are used for the initial covering of open wounds to prevent further contamination. Bandages are materials used to hold the dressings in place. All open wounds require dressing and bandaging to prevent contamination, to absorb blood and wound secretions, and to control bleeding. A combination of dressings and bandages is used to control bleeding through direct pressure; this is the first choice for controlling heavy bleeding.

Triangular bandages are used to cover dressings and to make slings. Slings can be used for immobilizing fractures and other injuries, usually of the upper limbs. This helps to prevent further damage to tissue.

14. Fractures, dislocations and soft tissue injuries

Fractures, dislocations and soft tissue injuries may appear in isolation, or in combination together or with other injuries including lacerations or abrasions (wounds), concussions or even medical conditions to name but a few. This chapter focuses on providing the knowledge required related to fractures, dislocations and soft tissue injures and general treatment considerations. As a patroller, you may encounter multiple injuries and may need to adjust the treatment protocol to achieve the treatment outcome for the combined site of injuries or conditions. Understanding the principles, the logic and rationale that is the basis for the treatment described will allow you to adapt your approach to achieve the desired outcome in stabilizing the injury to move to the next level of care.

Learning outcome:

Recognize, understand, and explain the treatment of fractures, dislocations and soft tissue injuries.

Upon completion of this chapter you should be able to:

1. Explain the different types of fractures.
2. Describe the signs, symptoms and treatment of fractures.
3. Describe the purpose and appropriate use of traction.
4. Describe the signs, symptoms and treatment of dislocations.
5. Identify the differences between strains, sprains and tendon injuries.
6. Explain the basic treatment of strains, sprains and tendon injuries.

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Fractures

A fracture is a traumatic disruption of the normal architecture of a skeletal bone. In other words, it is any break in a bone. It is usually caused by trauma and, less frequently, by muscle action. It can also result from a diseased condition within the bone.

Some fractures may simply be cracked bones with no evidence of deformity; other fractures may show evidence of considerable displacement or angulation.

A soft tissue envelope which consists of the muscles, tendons, neurovascular structures (nerves and blood vessels), fascia and subcutaneous fat and skin surrounds the bone. Aside from the surface of the skin, this is a sterile environment that protects, nourishes and functions in harmony with skeletal bone.

Closed fractures

Closed fractures are those in which the soft tissue envelope remains generally intact. They do not result in an open wound, therefore they do not become exposed to the environment and hence represent little danger of infection.

Open fractures

Open fractures are those in which the soft tissue envelope and the skin are breached resulting in an open wound, for example, a puncture wound or a protruding bone.

It is possible that the wound was caused by interaction with the external environment. For example, a puncture from a tree limb or a laceration from a ski caused the fracture. A fractured bone may also have been driven through the soft tissue and skin, causing the wound. In any case, the bone does not need to protrude or have appeared outside the skin for the fracture to be classified as open.

Due to the open nature of the wound, the fracture is exposed to bacteria which could result in an infection. An infected fracture is a serious problem that is difficult to manage. This underlines the importance of initial management of open fractures by patrollers. (see Open fracture and cover bandage in Chapter 13).

For information only

Definitions of common terms used in fracture management and communication with health care providers.

Diaphysis

The centre portion of a long bone made up of cortical bone and commonly called the shaft of the bone. This is comprised of a ring of very dense bone around a fatty intramedullary canal.

Metaphysis

The metaphysis is the wider portion of a long bone that contains the epiphyseal plate in growing children. It is comprised of cancellous bone with its characteristic honeycomb architecture.

Epiphysis

The end of a long bone that connects with a joint. It is comprised of cancellous bone, subchondral bone and articular cartilage.

Epiphyseal plate

The cartilaginous layer found within the metaphysis of growing children from which bone growth occurs. Cartilage cells divide and ossify (harden into bone) in both the diaphysial and epiphyseal direction (length and thickness) giving bone further length and size. Knowledge of this layer is important as it is weaker than the surrounding bone and often a site of fractures in growing children. The epiphyseal plates ossify between 15 and 21 years of age which is characterized by the plate being no longer being present or visible on x-rays, and the cessation of growth.

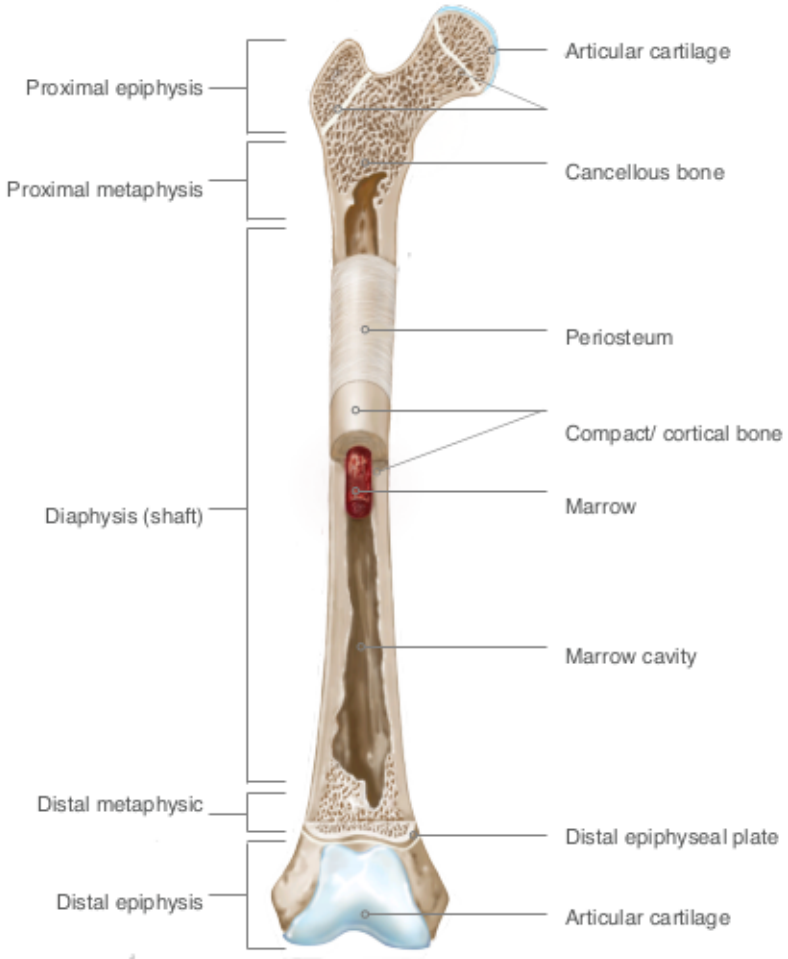

Figure 14-1: Anatomical terms of bone.

Categories of fractures

Greenstick

This is a soft bone fracture where the bone cracks or bends through the shaft, rather than breaking completely through. This is most commonly found in children.

Transverse

This is a fracture that is perpendicular to the diaphysis (shaft) of the bone.

Oblique

This is a fracture occurring at an angle to the diaphysis (shaft) of the bone.

Spiral

This is a fracture in which the fracture lines spiral around the diaphysis (shaft) of the bone.

Comminuted

This is a fracture consisting of more than two pieces.

Impacted

This is a fracture where the broken ends have been driven into one another and usually occurs in metaphyseal cancellous bone (i.e. tibial plateau).

Extra-articular

This is a fracture that does not involve the joint surface.

Intra-articular

This is a fracture where the joint surface is affected, and can lead to long-term consequences of arthritis.

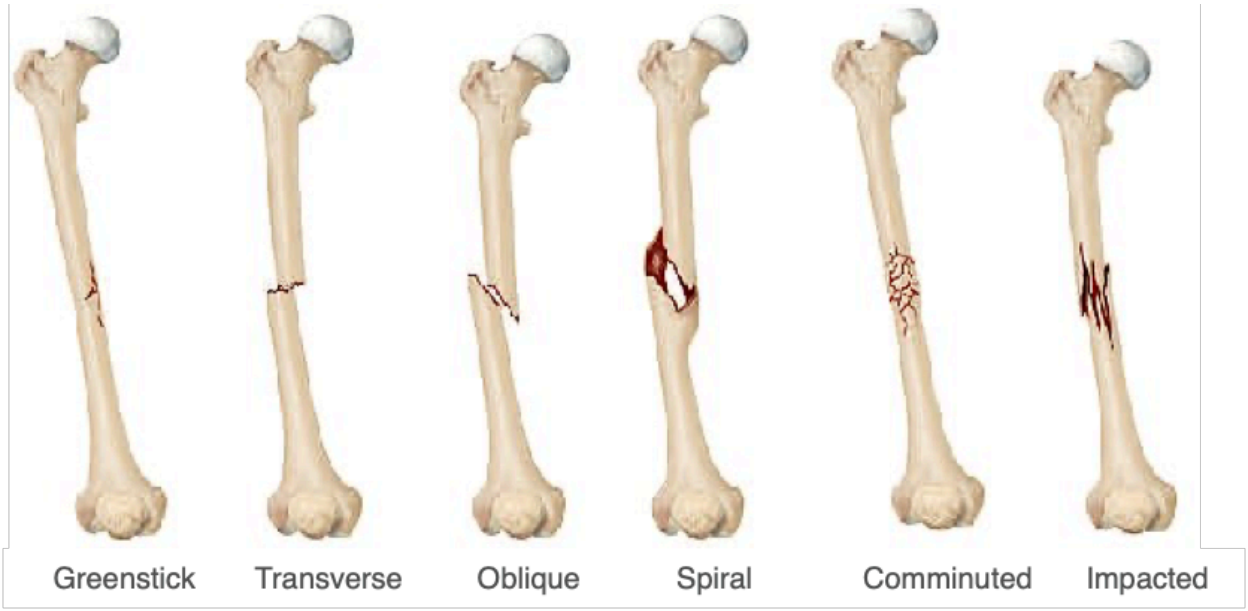

Figure 14-2: Categories of fractures

In describing fractures you can use a combination of all above terms (for example, an open, comminuted, impacted, intra- articular fracture.)

Fracture management

Definitions for fracture management

For the purpose of this chapter some definitions and principles of trauma will be made in the context of a non-hospital environment where x-rays and advanced diagnostics are not available.

Traction

The use of physical force (usually a pull) on a limb for the purpose of adjusting limb from a deformed position to a realigned position in preparation for splinting or transport.

In-line traction

The principle of using a physical force on a limb initially in the direction of the deformity with a goal of decreasing the deformity to a near-normal position. This force is maintained while a splint is applied and may be continued in most lower extremity fractures. It maybe released for transport in most upper extremity fractures.

If the fracture is displaced and the limb misaligned, re-alignment should be attempted prior to splinting. With both sides of the fracture site stabilized manually, apply a pull along the long axis of the bone (in its normal setting) first and then, move the distal end of the limb back into its normal position. If the limb has been rotated as part of the mechanism of injury, rotating the limb back to its pre-injury position prior to splinting is appropriate.

Counter-traction

The force used to stabilize the skeletal frame of the injured person while traction is being used to realign the limb involved.

Maintained in-line traction

For femur fractures and tibia fractures in-line traction may be maintained during transport and appropriate splints designed for this purpose should be used.

Force of traction

Varies with the size of the patient, the limb involved, the amount of deformity, and the ease or difficulty of realignment.

Realign

The procedure of taking a deformed fracture to a near-anatomical position. This is not the definitive treatment of the fracture but optimizes the tissues' environment and improves the ease of splinting and transport.

Anatomical position

The natural or neutral position of uninjured bones and joints. This position is often depicted as a person in a supine (or standing) position with arms at their side, palms forward and legs straight and extended. This is a visual perception in the field and is not an exact position.

Further assessment, imaging and management, including definitive fracture reduction and possible fixation/stabilization will often be necessary in a hospital environment.

Signs and symptoms

As a patroller, you should assess the situation and gather as much information as possible either by asking the patient directly or by asking bystanders.

Questions that you should ask follow the patient assessment progression:

- Is or was the patient unconscious?
- Where does it hurt?
- Can the patient bear weight on the injury?
- Is the patient protecting any particular part of their body?
- Did the patient hear a noise such as a crunch or snap?

Assess if there is:

- swelling at the injury site
- skin discolouration
- inability to move the injured limb, deformity of the limb
- a wound
- point tenderness at the injury site
- unwillingness to move the injured area (guarding)

Some serious fractures have been known to produce few signs or symptoms.

A fracture may give very little pain as long as the patient does not move.

Treatment overview

Because of the diversity of this type of injury, the treatment of fractures is more generalized than some of the other topics discussed in this manual.

Basic aims

The patroller's focus in working closely with their patient will include:

- providing a level of pain relief
- detecting and alleviating pressure on blood vessels and nerves by bone ends or joints
- preventing closed fractures from piercing the skin during handling or applying a splint incorrectly
- reducing the possibility of an open fracture becoming infected
- preventing internal injuries from fractured bones
- caring for associated conditions such as hemorrhage and shock
- generally providing patient comfort when moving the next level of care

Rationale for realignment of fractures

Pre-hospital care realignment of a deformed limb decreases the morbidity and improves the outcome of the injury at many levels.

Pain

Realigned limbs have less pain. Pain scores pre- and post- realignment are encouraged and should be documented and tracked (e.g. "pain severity from 0 to 10, 10 being the worst").

Hemorrhage

A shortened and angulated long bone fracture has greater potential of blood loss (e.g. femur). Realignment and traction will decrease hemorrhage.

Skin

Tenting of the skin over a deformity can cause local ischemia and mechanical damage that can cause local breakdown of the skin. This can have a significantly negative impact to the management and outcome of the limb in hospital care. This includes increasing the risk of infection, compromise of surgical incisions and causing wound healing problems.

Nerves

Prolonged tenting of a nerve over a deformed fracture can cause local ischemia in the nerve and can also cause either bruised nerves (neuropraxia) or nerve death. Realignment can prevent temporary or permanent nerve damage.

Arteries and veins

Tenting of arteries and veins over a deformity can cause loss of blood supply (ischemia) and venous pooling below the fracture. This can lead to muscle death, increase the risk of compartment syndrome and can have systemic effects from muscle death.

Soft tissue envelope

Muscle, tendon and fascia can be permanently damaged by being tented over a deformed fracture, with possible long term repercussions. Realignment of the soft tissue envelope will decrease muscle death and decrease the chance of tendon rupture.

Bones and joints

Maligned limbs can cause decreased blood supply to bones and joints. This can lead to tissue death (avascular necrosis) in some joints and increased risk of arthritis.

General procedure - limb fractures

When encountering a patient with a suspected fracture, a patroller needs an approach to managing the injured limb(s).

1. Primary assessment

   The primary assessment and critical interventions take priority over fractures. Once an initial survey and life-threatening injuries are dealt with and the patient assessment is completed, then management of the fracture(s) can take place.

2. Examine the limb

   Check for breaks in the skin, indicating an open fracture, and the presence of distal circulation and nerve function when and where appropriate. Do a distal PMS check (see Pulse, motor response and sensation in Chapter 4).

3. Handling the limb

   In-line traction is the best means of handling a limb (deformed or not) to enable proper wound management of an open fracture, and for the application of splints and packaging for transportation. Exercise gentle and slow movement at all times.

   If there is a significant deformity in the limb, the soft tissues and neurovascular structures may be compromised with the risk of long-term disability. Reducing the deformity of a fracture in the field can significantly reduce the possibility of further damage to the whole soft tissue envelope, including the neurovascular structures, muscles and tendons and the skin envelope itself. There is also a substantial reduction in pain.

4. Realign the fracture

   - For non-deformed fractures

     Use gentle in-line traction to stabilize the limb for wound management, splinting, and preparation for transport.

   - For a deformed fracture

     After an inspection of the skin and a neurovascular exam are complete, one patroller stabilizes the limb above the fracture site (counter-traction) while another one pulls the limb with appropriate and sufficient force of traction. Realigning the angulation involves two steps. First, one pulls in-line with the deformity. Secondly, the distal limb is then gradually and slowly moved back towards its normal anatomical shape. The amount of force applied depends on the size of the patient, the bone and site involved and the experience of the patrollers involved.

5. While maintaining traction, the wound can be managed and a splint can be applied to the limb.

   The goal of the realignment is to restore the shape of the limb which optimizes the environment of the bone and the soft tissue envelope, making it easier to manage the wound and splint the fracture resulting in increased patient comfort for transport.

   Traction may also be used with fractures that have occurred close to joints. In the field, it is impossible to know if a fracture is intra- or extra-articular. A joint fracture, such as a tibial plateau fracture at the top end of the tibia, is best managed by traction to realign the knee and then stabilize. An elbow fracture is the only joint that may be more comfortable to splint in a flexed position, but it is also acceptable to attempt to straighten it to stabilize.

   Sometimes it is not possible to move the limb to its normal anatomical position due to the pain this causes the patient or the inability to move the bones. In that case, splint in a position of comfort.

6. Wound management

   If a wound is open in a cold environment, covering the wound with a sterile gauze dressing is often most practical. If bone ends are protruding from the skin it is best to deliver the bone end back inside the skin envelope. This often occurs during realignment of the fracture with traction but occasionally needs the help of a gloved finger to tuck it in. Despite being contaminated, this is the best environment for the bone and will help prevent infection and loss of blood supply to the bone ends.

   In a warmer first aid environment, especially if the wound is grossly contaminated, it is best to wash the wound with saline or water and apply a moist saline gauze dressing to help keep the soft tissues viable.

   Rapid administration of antibiotics is important to prevent infection. Communication to the transport crew of an open fracture speeds up the preparation of an intravenous and antibiotics.

7. Splinting the fracture

   With the splinting materials and devices available, the principle is to stabilize the fractured bone, including the joint above and below the deformity. Once secured in a splint the manually applied traction is most often gently released for transport.

8. Maintained traction

   Traction also can be maintained to keep the alignment of the limb, most commonly seen with the femur and tibia. A Sager splint is an example of a splint used to maintain traction for a femur fracture and a Sun Valley splint is an example for a tibia fracture.

9. Re-examine pulse, motor and sensation (PMS)

   Once realigned and splinted, if possible, reassess the pulse, motor and sensation (PMS) response of the limb. If there is a loss of pulse, motor or sensation (PMS) either prior to or after splinting a limb the patroller should consider loosening restrictive splinting, but most importantly there is an urgent need to get to advanced medical care, documenting and communicating any perceived loss.

10. Package for transport

    Appropriately pad and secure the patient for transport.

Dislocations

A dislocation is the displacement of a bone end from its normal position in a joint. It may result in severe nerve and blood vessel damage and can be very painful.

Dislocations are usually caused by falls, impacts or muscular effort. The surrounding ligaments and other soft tissues always suffer some injury.

The joints most frequently dislocated are the shoulder, elbow, knee, ankle, wrist, thumb and fingers.

Signs and symptoms

- deformity around the joint
- swelling around the dislocated area
- severe pain
- inability to move or use the joint

Treatment

Do not attempt to reduce the dislocation. Treat as a fracture and attempt to stabilize.

1. Assist the patient in keeping the limb in the most comfortable position.
2. Assess the neurovascular status by means of a distal pulse, motor and sensation check, before and after any attempted stabilization (see Pulse, motor response and sensation in Chapter 4).

If distal circulation is absent or decreased, activate EMS and treat as a Load and Go.

3. Immobilize the limb in the position in which it is found or in the most comfortable position for the patient (see Stabilizing fractures, dislocations and soft tissue injuries in Chapter 15).
4. Recommend the patient seek further medical aid.

Dislocations often cause the limb to protrude in an awkward position. You may be forced to improvise in order to stabilize a dislocation effectively, such as using blankets to fill in the space between the limb and the body.

Strains, sprains and tendon injuries

The bone ends forming a joint are held in position by strong bands of tissue called ligaments. The joints are moved by muscles. The muscles are connected to the bone by tendons.

Differences between strains, sprains and tendon injuries

Many people often confuse strains, sprains and tendon injuries.

Strains

an over-stretching or over-exertion of muscles or tendons. Pain is usually the main symptom associated with this injury.

Sprains

The wrenching or twisting of a joint, with injury to or partial rupture of its ligaments. There may also be damage to the nearest blood vessels, muscles, tendons and nerves. Sprains commonly occur at the ankle, elbow, knee, wrist and thumb.

Signs and symptoms

- pain (can be so extreme in some cases that the patient will refuse to move the joint)
- swelling
- reddish or blue discolouration (bruising) due to hemorrhage from ruptured blood vessels

Tendon injuries

Tendon injuries are caused by over-stretching a tendon beyond its limit of elasticity, or repetitive micro-trauma. Common causes of tendon injuries are sudden muscular exertion, such as lifting or falling, which twists or wrenches the joint beyond its normal range of movement.

Signs and symptoms

- swelling
- inability to move the limb
- deformity
- reddish or blue discolouration (bruising) in the area of injury due to hemorrhage from ruptured blood vessel

- severe pain at the site of the injury at the time of injury
- increased pain with attempted use of the limb
- stiffness

Treatment

Treat sprains, strains and tendon injuries as fractures. Support the limb but do not pull it. Recommend the patient seeks further medical aid. They should be treated by remembering the acronym **RICE.**

R	Rest	Rest is accomplished by restricting movement and splinting, as appropriate.
I	Ice	Ice is applied by means of a cold pack, or a plastic bag filled with snow, for no longer than ten to 15 minutes at a time. Do not apply the cold pack directly to the skin without an insulating layer such as clothing or a towel; however, it may be applied with compression (see below). Remove the cold pack if the patient complains of discomfort. Frequently examine for signs of cold injury. When used successfully, it can be applied indefinitely in a cycle of: • Ten to 15 minutes on. • Ten to 15 minutes off. Cold has the advantage of reducing both pain and swelling. Contraindications to the application of cold include the lack of distal circulation, snake bites and cold injuries.
C	Compression	Compression is applied by elastic-type compression bandages. Take care to check distal circulation before and after applying compression. Compression also helps relieve pain and reduce swelling.
E	Elevation	Elevation also helps reduce swelling, particularly when the injured area can be elevated above the level of the heart.

Repetitive strain injuries (RSI)

Repetitive Strain injuries (RSIs) involving shoulders, arms, elbows, hands and wrists as well as knees, feet and legs, are a common sight at any sporting event.

Examples of repetitive strain injuries include:

Tennis elbow / Golfer's Elbow / Tendonitis

Any repetitive activity that stretches the tendons in the elbow beyond capacity to the point where they become inflamed.

Iliotibial (I.T.) Band Pain

Knee pain felt on the outside of the knee or full length of the thigh, generally due to overuse.

Patella Tendonitis (Jumper's Knee)

The inflammation, degeneration or rupture of the patellar ligament and the tissues that surround it, leading to pain and discomfort in the area just below the knee cap

Runner's Knee (Patellofemoral Pain)

pain in the patellofemoral area caused by placing heavy stress on the knee.

Anterior Tibialis (Shin) Splints

Pain localized around the front of the lower leg, along the tibia, caused by continuous stress or jarring of the bones, muscles, and joints without appropriate periods of rest.

Plantar Fasciitis

A painful condition caused by overuse of the plantar fascia (arch tendon) that connects your heel bone to the base of your toes. It can become chronic if not treated.

Heel Spurs

A heel spur is a growth of bone on the bottom of the heel.

Signs and symptoms

Symptoms tend to develop gradually and become more severe over time.

- pain
- dull ache
- throbbing
- tingling
- numbness
- tightness

Treatment

1. Rest.
2. Ice.
3. Refer to a qualified injury specialist or seek medical aid.

Conclusion

Unless a life-threatening condition exists, fractures, dislocations and soft tissue injuries are usually categorized as a stay and treat situation and should be treated only after the secondary assessment has been completed. Always consider that fractures to major bones or the spine are very serious but are not classified as a Load and Go unless other life threatening conditions are present such as major bleeding, respiratory distress, etc. If life threatening conditions exist, treat these first and declare a Load and Go.

Fractures of the femur(s) or the pelvis are Load and Go injuries due to their potential to put the patient into shock.

15. Stabilizing fractures, dislocations and soft tissue injuries

This chapter continues on from the general characteristics of fractures, dislocations and soft tissue injuries covered in chapter 14. The content focuses on each of the most frequently encountered fractures, dislocations and soft tissue injures and how to treat each in isolation. Specific injuries are described along with signs, symptoms and treatment.

It is critical to factor in the importance of the positive relationship that is developed during the patient assessment to identify signs and symptoms, gather relevant information, and to gain the patient's cooperation during the treatment procedure. Ongoing communication with the patient is a key component in successful assessment and treatment. While not alluded to specifically during the treatment descriptions provided in this chapter, keep this in mind throughout.

Learning outcome:

Recognize, understand, and demonstrate the treatment of fractures, dislocations and soft tissue injuries.

Upon completion of this chapter you should be able to:

1. Demonstrate the correct treatment for each injury found in this chapter.
2. Provide inline traction and remove boots.

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Splints

A splint is a material or a device used to stabilize a suspected fractured bone and the joints above and below the fracture and to stabilize a suspected sprain or dislocation.

Purpose of splints

- protect the injured area
- give support and prevent further injury to the injured area
- where possible, stabilize the joint above and below the fracture or the injured joint itself

Characteristics of splints

- long enough to stabilize the joints above and below the injured area
- wide enough to protect the injured area
- strong enough to provide the required support
- well padded to stabilize the injury without causing further pain or pressure

Commonly used stabilization devices

Backboards

Usually, these are used to stabilize the whole body and head. They are most useful for neck, upper body, pelvic, hip, femur, multiple fractures, multiple injuries and all Load and Go situations. Backboards are also used for extraction and transportation in addition to splinting.

Cardboard splints

Usually these are used for lower arm, knee and lower leg injuries.

Sun Valley splints

These are commonly used as lower leg and knee splints. They have a plastic or wood frame with a soft foam inner surface that provides padding for the leg. Straps and quick release buckles are used to reduce splinting time. Adult and child sizes are available.

Wire mesh or metal core splints

These splints are available in different sizes for use on upper and lower limbs. One popular metal core splint is the SAM splint, which is covered with soft foam and can be cut to size.

Vacuum splints

These splints are available in different sizes for use on upper and lower limbs and as a vacuum mattress for the whole body. When the air is extracted, they form a rigid structure to support the injured limb. Follow the manufacturer’s instructions for use. The leg vacuum splint could be used in some cases as a baby vacuum mattress.

Improvised splints

These are objects such as corrugated cardboard, blankets, pillows, skis, ski poles, rolled-up magazines used in lieu of commercially-available or specially-manufactured splints.

Other considerations

Splint material must be chosen according to the job it has to do. In some cases, the body of the patient can be used as a splint. For example, a fractured arm can be tied securely to the body. Another example is securing a fractured leg to the uninjured leg if no other materials are available.

Splinting techniques vary from sport to sport, as the patient's clothing and footwear is very different. Speed skates, soft shoes or bare feet require an alternate approach, specifically when

considering a lower leg splint. Plastic corrugated, air or vacuum splints should be considered. These splints come with specific instructions. Reference these instructions prior to their use.

PMS evaluation

Check the pulse and colour distal to the injury before and after applying a splint to ensure that it has not restricted circulation nor neural functions (see Pulse, motor response and sensation in Chapter 4).

If distal pulse is absent after splinting, loosen the splint but do not remove it. If distal pulse is still absent, do not attempt to restore circulation by repositioning the injured limb. This may cause further damage. Activate EMS and treat as a Load and Go.

If the patient is wearing a high, rigid boot, pulse and sensation may be checked at the ankle or lower leg. Motor response is more difficult but patient can be requested to “wiggle toes" with feedback provided.

Inline traction

If the fracture is displaced and the limb is misaligned, re-alignment should be attempted using inline traction prior to splinting.

Inline traction for the lower arm is applied by one or two patrollers, as shown in Figure 15-1. If one patroller is used, a straight arm applies counter traction on the upper arm immediately above the elbow and the patient's hand is gripped by the patroller and traction applied. Traction will be maintained until the limb is stabilized in a splint. If two patrollers are used, one patroller applies counter traction by holding the upper arm just above the elbow and the second patroller holds the patient's hand and applies traction. The patrollers applying the in-line traction should position themselves so as not to interfere with the application of the splint.

Inline traction for the lower leg is applied by one patroller with a stirrup bandage (the patient's body weight serves at counter traction), as shown in Figure 15-1 below.

Figure 15-1: Overhand, handshake and underhand grips to apply in-line traction

Removing boots

While in place, the ski boot may be acting as a splint for an ankle or foot injury. Removing the boot is only permitted in the first aid room. It is done only to assess the injury site. Boot removal works best when the patient's boot is over the edge of the examination table. The procedure for removing a ski boot requires two patrollers and is as follows:

Patroller 1: stabilizes the leg, as close to the boot as possible.

Patroller 2: releases the buckles on the boot, pries open the boot as much as possible and stabilizes the foot while,

Patroller 1: slides their hands as far into the boot as possible to stabilize the ankle

Patroller 2: removes the boot with a rotation of the toe of the boot towards the patient to reduce the flexing of the ankle or foot of the injured leg.

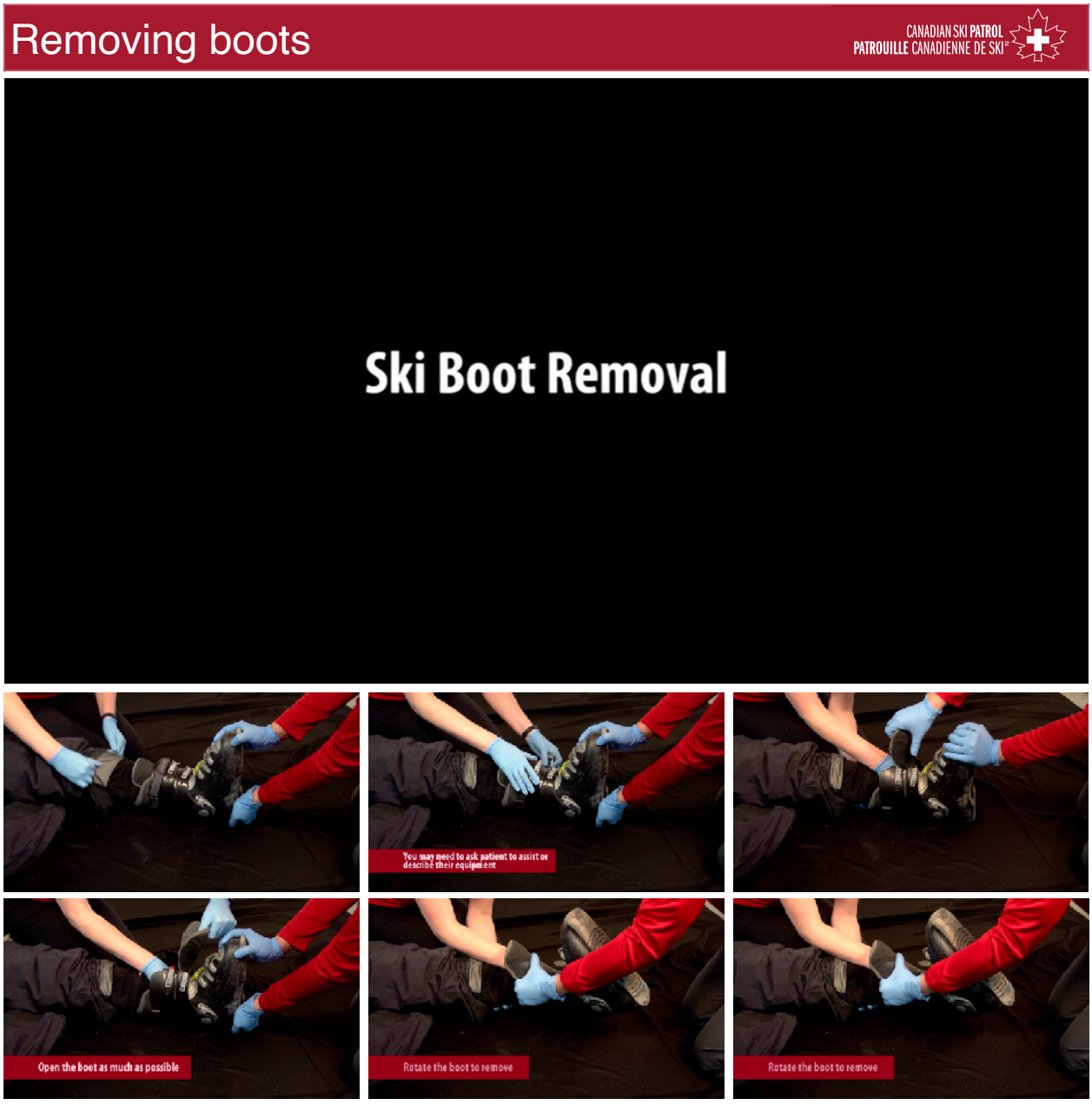

Removing boots
CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI
Ski Boot Removal
You may need to ask patient to assist or describe their equipment
Open the boot as much as possible
Rotate the boot to remove
Rotate the boot to remove

Figure 15-2: Boot removal.

Patrollers should consider making a ‘dry run” by removing the boot from the uninjured leg first so that the patient will know what to expect and the patrollers get a chance to evaluate the characteristics of the boot.

Clavicle and Scapula

Clavicle

Signs and symptoms	Treatment
• point of the shoulder rolls forward, inward and down • possible extreme pain • deformity • protruding bone • patient holds their arm across their body	The position of a clavicle fracture can be greatly improved by encouraging the patient to assume a position with shoulders back and chest out (not a slouched position). This optimizes the length of the clavicle and makes it less likely to tent the skin. 1. Check distal PMS. 2. Apply a large arm sling holding the patient's arm in the most comfortable position. 3. Immobilize the injured arm to the patient's body - in the most comfortable position - with a transportation bandage over the elbow and hand. Gently pull on the transportation bandage to roll the point of the shoulder backward to relieve pain. 4. Tie the transportation bandage on the side opposite the injury. Use padding if necessary. 5. Recheck distal PMS. 6. Transport the patient in a position of comfort.

Fracture of the clavicle is a common injury produced by a fall on an outstretched hand or on the point of the shoulder. The clavicle acts as a spreader to brace the shoulder back. Injuries to the scapula are generally the result of impact (trauma). The standard treatment for both injuries is using a large arm sling and a transportation bandage.

Scapula

Signs and symptoms	Treatment
• pain at the injury site • the point of the shoulder will roll slightly back	1. Check distal PMS. 2. Apply a large arm sling holding the patient's arm in the most comfortable position. 3. Immobilize the injured arm to the patient's body - in the most comfortable position - with a transportation bandage over the elbow and hand. Gently pull on the transportation bandage to roll the point of the shoulder forward to relieve pain. 4. Recheck distal PMS. 5. Transport the patient in a position of comfort.

Figure 15-3: Large arm sling with transport bandage.

Shoulder

Shoulder dislocations are the result of the humerus bone being pulled from its socket. Generally, shoulder dislocations happen as a result of the patient's body tumbling.

Shoulder	
Signs and symptoms	**Treatment**
• localised pain at the injury site • the inability to bring the arm down to the patient's side • deformity	1. Check distal PMS 2. Allow the patient to support their arm in the most comfortable position. If this is not possible, have a helper support the arm. 3. Secure a blanket, padding, pillow or clothing with a bandage to support the arm in a position of comfort. 4. Allow the patient to continue holding his arm in the most comfortable position. 5. Check the distal pulse after treatment is complete.

Figure 15-4: Dislocated shoulder treatment.

Upper arm

A fracture of the humerus between the shoulder and the elbow.

Transportation

If there are no other injuries that dictate otherwise, to maintain traction by gravity, the patient may be transported sitting up or in a position providing patient comfort.

Upper arm (humerus)

Signs and symptoms

- deformity
- swelling
- severe pain
- the inability to move the arm

Treatment

If the arm can be bent at the elbow:

1. Check distal PMS.
2. Manual traction can be applied by gripping the elbow and pulling along the long axis of the humerus while applying counter traction by placing a hand in the armpit. Once the small arm sling and transportation bandages are applied, manual traction can be released.
3. Place the arm in a small arm sling in a position of comfort. This allows the elbow to hang free, thus providing traction by gravity to the broken bone.
4. Pad between the elbow and the chest for comfort and to assist with maintaining alignment of the humerus.
5. Further stabilize the arm with two transportation bandages, if possible.
6. Recheck distal PMS.
7. If there are no other injuries that dictate otherwise, to maintain traction by gravity, the patient may be transported sitting up or in a position providing patient comfort.

If the elbow cannot be bent :

Immobilize the arm straight alongside the body, tying it at the chest and hips, and check the distal pulse and sensation after completing the treatment.

The patient will have to be transported supine.

Remember to always check the distal pulse and sensation after treatment is completed.

Figure 15-5 : Small arm sling and transport bandages

Elbow (dislocated or fractured)

Dislocated or fractured elbow

Signs and symptoms	Treatment

• swelling
• deformity of the joint
• pain
• possible numbness in lower arm or wrist
• discolouration at injury site
• pain or inability to use the limb
	1. Verify radial pulse before treatment. Distal pulse checks are especially important before and after treatment to ensure proper circulation is not lost during the process.
	2. Maintain the arm in a position of comfort.
	3. If possible, place the arm in a large arm sling.
	  • Fully support the arm during treatment and keep manipulation to a minimum.
	  • If it is not possible to use a large arm sling, stabilize the arm against the body in the position found, using transportation bandages.
	  • Pad all hollows.
	4. Apply transportation bandages over the large arm sling and over both the upper and lower arms to prevent excess movement during transportation.
	5. Alternatively, a smaller version of the bent-knee splint may be used to stabilize a dislocated elbow.
	6. Recheck distal pulse and sensation upon completion. If the pulse is absent after treatment, reposition the arm and recheck.
	7. Transport to medical aid.

Do not cause additional discomfort to the patient when tying the bandages. Treat the inability to restore the distal pulse as a Load and Go.

Lower arm, wrist and hand

Any fracture of the arm below the elbow, or of the wrist or the hand, requires a lower arm splint. The method of stabilization, however, will vary according to size of limb and the injury.

Lower arm

CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI

Signs and symptoms	Treatment
• swelling • deformity • pain • discolouration at the injury site • inability to use the arm	1. If the forearm, wrist or hand is in a deformed position with obvious angulation apply inline traction to realign the deformity towards the correct anatomical position. If the limb does not realign with attempted inline traction, then splint in the deformed position. 2. Ensure the arm is stabilized by one patroller throughout the splinting process, whenever possible. Place the arm in a padded splint which covers both the anterior and posterior of the lower arm and hand. The splint should extend beyond the fingertips and elbow. 3. Apply the first bandage as close as possible to the elbow, ensuring that circulation is not impaired. This acts to hold counter traction when the patroller releases traction. Place the centre of the bandage on the outside of the splint. Pass the ends around and tie on the outside of the splint with a reef knot. 4. Tie a figure-of-eight bandage around the wrist and hand to stabilize the wrist. a) Start with the centre of the bandage at the bottom of the splint at the wrist and bring the ends around to the top of the splint still at the wrist. b) Cross the ends and bring them back down to the bottom. c) Cross again and bring back the bandage in front of the thumb and tie. d) Note that the fingers and thumb should be exposed to check for circulation. 2. The figure of eight maintains traction of the lower arm when the patroller releases traction. 5. Use a large arm sling to support and immobilize the lower arm. 6. Apply a transportation bandage around the elbow and cross it under the distal end of the splint and tie on the uninjured side. Add padding under the knot as necessary. 7. Check distal pulse motor response and sensation.

Do not cause additional discomfort to the patient when tying the bandages. Treat the inability to restore the distal pulse as a Load and Go.

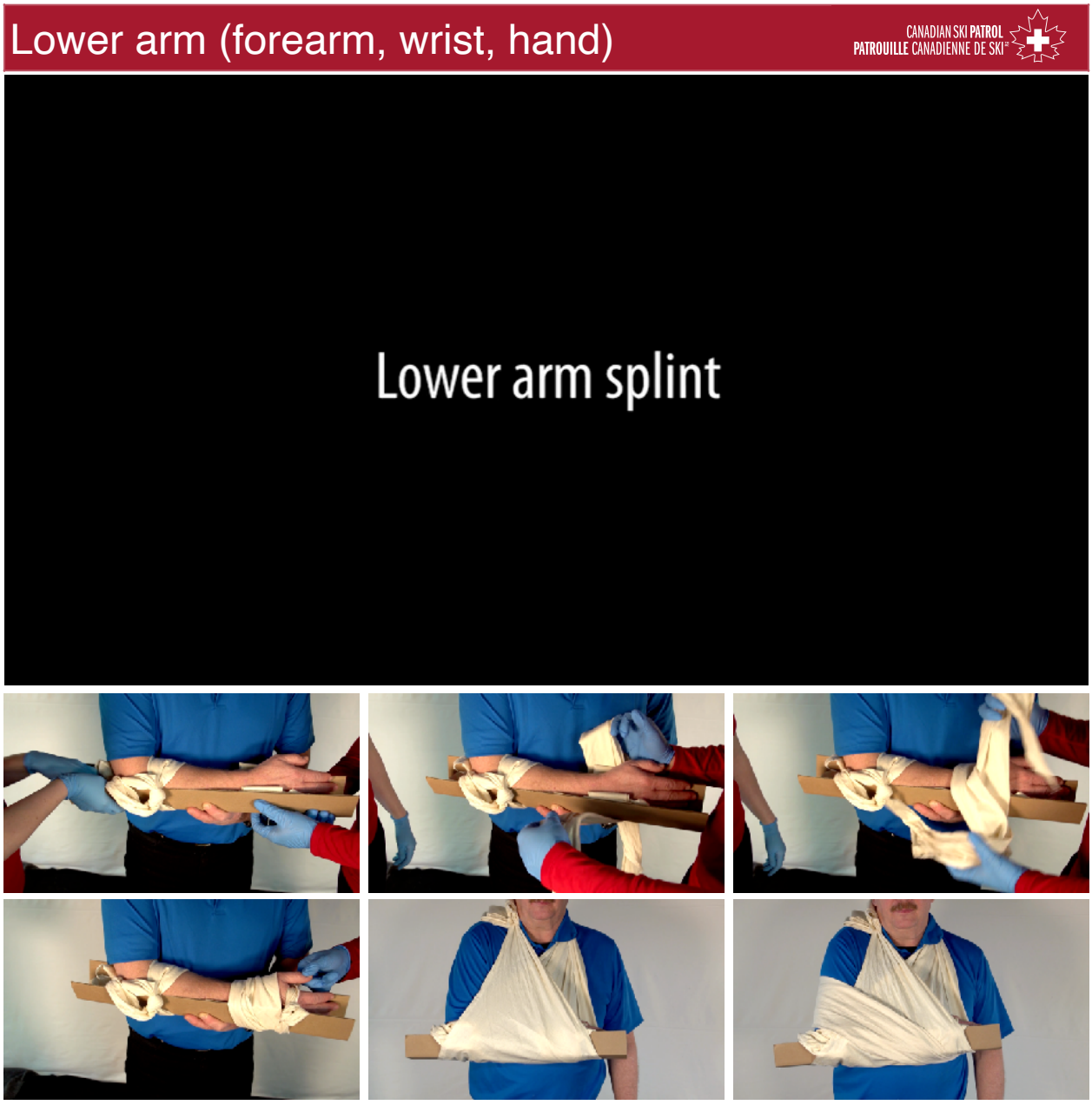


Figure 15-6: Lower arm traction and sling.

Fractured finger

Injuries to the wrists, hands and fingers are common even in minor mishaps, such as slow-speed falls.

Fractured finger	
Signs and symptoms	**Treatment**
• pain • swelling • deformity • inability or unwillingness to move the injured part	1. Check PMS 2. Realign any deformity with inline traction. 3. Either splint using a tongue depressor, or tape a good finger to the injured finger. 4. Apply a body sling to elevate the injury. 5. Recheck PMS

Figure 15-7: Fractured finger stabilization.

Ribs

One or more ribs may be broken by a blow, a fall, a crush, or even by a squeeze. (see Rib fractures in Chapter 8)

Continuously monitor breathing. Be prepared to upgrade the situation to a Load and Go if breathing becomes increasingly difficult and ABCs are compromised.

Pelvic girdle

Fractures of the pelvis are usually the result of direct impacts at high speed against solid objects. Large blood vessels and nerves go through the pelvis. As a result fractures of the pelvic ring can bleed significantly. The other issue is that the pelvis is on the outside of the abdominal sac (peritoneum). Therefore pelvic bleeding travels on the outside of the abdominal contents, most often up the back and/or down the legs. The patient does not present with the same set of symptoms as an abdominal injury, only shock and instability on pelvic palpation.

The pelvis consists of six bones (three per side) all fused together. The three bones are the ilium, the ischium and the pubis. The suture line of the three bones runs through the acetabulum

Pelvic girdle

Signs and symptoms	Treatment
• inability to stand or walk • deformity, crepitus or unnatural mobility of the pelvic structure on assessment • tender abdomen • severe pain • inability to void, or blood may be seen in the urine or feces	1. Activate EMS. 2. Check distal PMS. 3. Pad between the legs for comfort. Place a broad bandage over the knees and around the ankles to secure the legs together. Pad under the knees as needed. 4. Layout two broad bandages on a backboard. Lift or roll the patient onto the board such that the bandages will sit one above the other with the topmost edge below the crests of the hips (one broad bandage around the hips may be sufficient for children or very small adults.) 5. Apply sufficient tension on each bandage to achieve pain reduction and relative comfort for the patient. 6. Tie each bandage on the side opposite the injury. 7. Secure the patient to the board, avoiding pressure on the pelvic area. If necessary, use extra padding along the sides of the patient and place a blanket or small pillow under the knees to maintain flexion. Apply the spinal motion restriction protocol and use spinal motion restriction if a spinal injury cannot be ruled out (see Tie down procedures in Chapter 11). 8. Recheck distal PMS. 9. Transport to medical aid. 10. Monitor for progression of shock. 11. If blood is noticed in urine, record in the intervention report.
Pelvic injuries can cause major discomfort. Be aware that, dependent on the severity of the pelvic injury, the patient's condition may deteriorate rapidly. Carefully monitor the patient's condition, activate EMS and treat as a Load and Go.	

(the socket for the head of the femur). The right and left sides are joined together at the back with the sacrum of the spinal column and are bound against a cartilage pad in the front.

The patient must be handled with great care to prevent further injuries. Try to move the patient as little as possible during treatment.

If instability or crepitus is felt during palpation of the pelvis, do not attempt to test the pelvis further.

Pelvic girdle fractures (bandages)

Figure 15-8: Pelvic stabilization with bandages.

Pelvic fracture stabilization device

There are several devices in the commercial market that are designed to splint a fractured pelvis. They include the Traumatic Pelvic Orthotic Device (T-POD) and the SAM Sling, shown in Figure 15-20. They consist of a wide non-elastic belt that goes around the pelvis and a tensioning device; a ratchet for the SAM Sling and a corset-like closure device for the T-POD. These devices may be used by patrollers.

Follow the manufacturer's instructions for the device application to determine if it may be applied before or after the patient is placed onto a backboard or vacuum mattress.

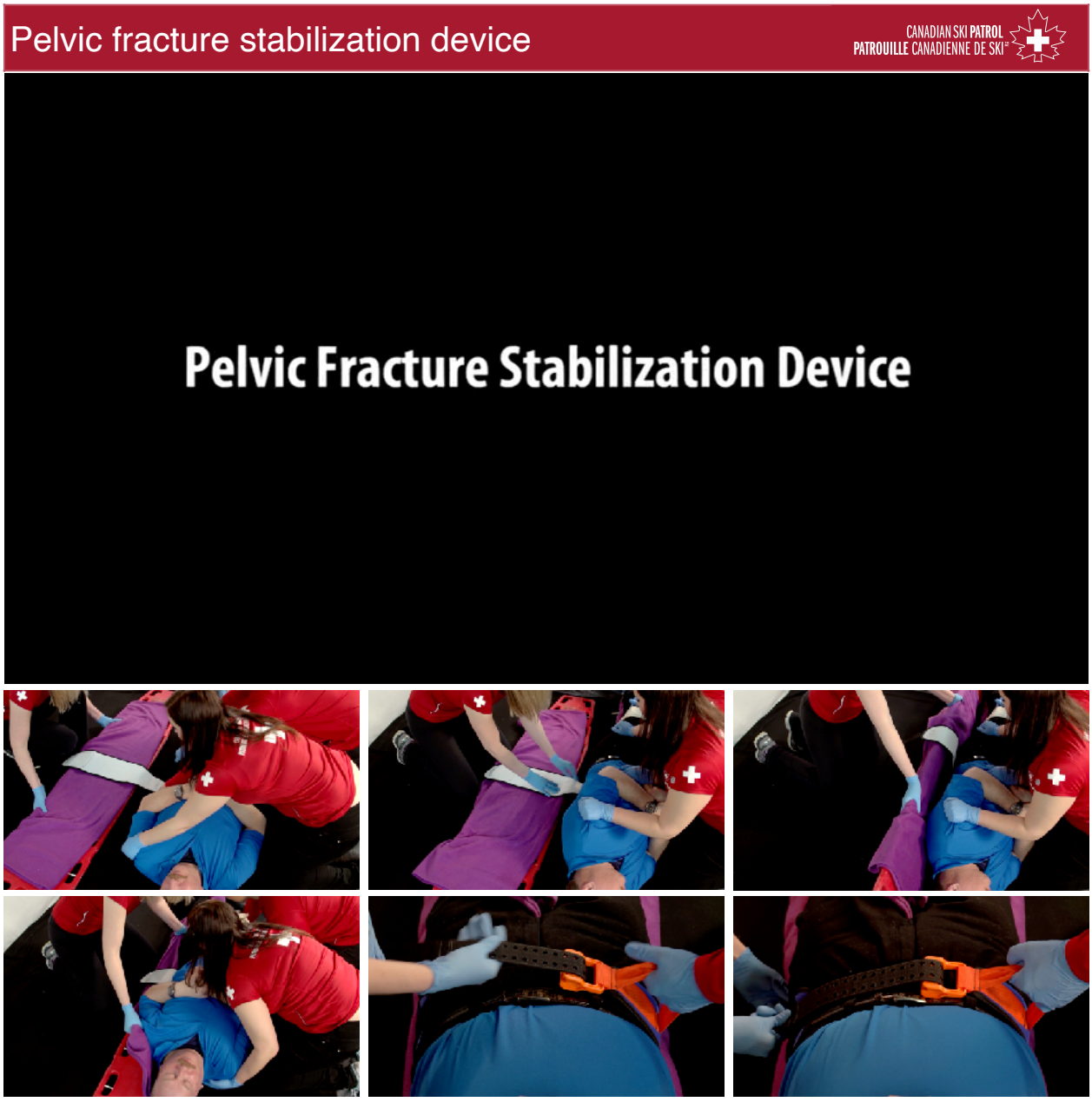


Figure 15-9: Pelvic stabilization with device.

Hip

A fracture of the upper end of the femur is often called a broken hip. Hip injuries are common in older people whose bones have become fragile. They are usually caused by a fall.

It is often difficult to differentiate between an upper thigh fracture and a pelvic fracture.

Hip injury

Signs and symptoms	Treatment
• tendency for the leg to roll outward so that the foot on the injured side points laterally while the foot on the uninjured side points forward • loss of distal circulation • shortening of the injured limb • swollen thigh on injured limb • pain in the groin • inability to move the injured limb	1. Check distal PMS. 2. Use inline traction to realign the extremity. 3. Use splints or the other leg to stabilize the limb. 4. Maintain traction with the appropriate splinting devices. 5. Recheck distal PMS. 6. Transport to medical aid.

Hip injuries can cause major discomfort. Be aware that, dependent on the severity of the hip injury, the patient's condition may deteriorate rapidly. Carefully monitor the patient's condition and be prepared to treat as a Load and Go.

Femur

Fractures of the femur are the result of high energy transfer. In some cases, the process of breaking the femurs absorbs energy, preventing damage to the core of the body. Femurs may also be at higher risk of breaking as a result of bone thinning due to calcium loss (osteoporosis).

The combination of significant energy transfer and the bleeding potential into the thigh make femur fractures a life-threatening injury. Therefore patients with femur fractures are to be treated as Load and Go priority patients.

With an intact femur, the thigh is a cylinder. When the femur is fractured, muscular contraction converts the shape of the thigh from a cylinder to a sphere. A sphere has a much greater volume potential and the internal pressure is lower, increasing the likelihood and potential volume of bleeding into the space. Remember that the various muscle compartments of the thigh are surrounded by fascia. The fascia can hold blood in the compartment like a balloon.

Traction restores the cylindrical shape of the thigh. As a cylinder, the volume of the thigh is smaller. Bleeding increases the internal pressure of the thigh, which eventually stops the flow of blood into the injury site. Because this process occurs with a lower volume, the amount of blood loss is less and the likelihood of shock is further reduced.

The patroller may feel crepitus as the traction is begun and a negative reaction initially from the patient. Perseverance is key, as is a steady pull.

Once counter traction is in place, if the knee and lower leg are intact and accessible, the patroller may grasp the ankle above the medial and lateral malleoli (ankle bones at the end of the tibia and fibula) and apply the pull through the lower leg. If for some reason this site is not accessible or usable, grasping just above the knee at the distal end of the femur is a good alternative. This is also the preferred site to use if there are multiple fractures of the femur.

Femur

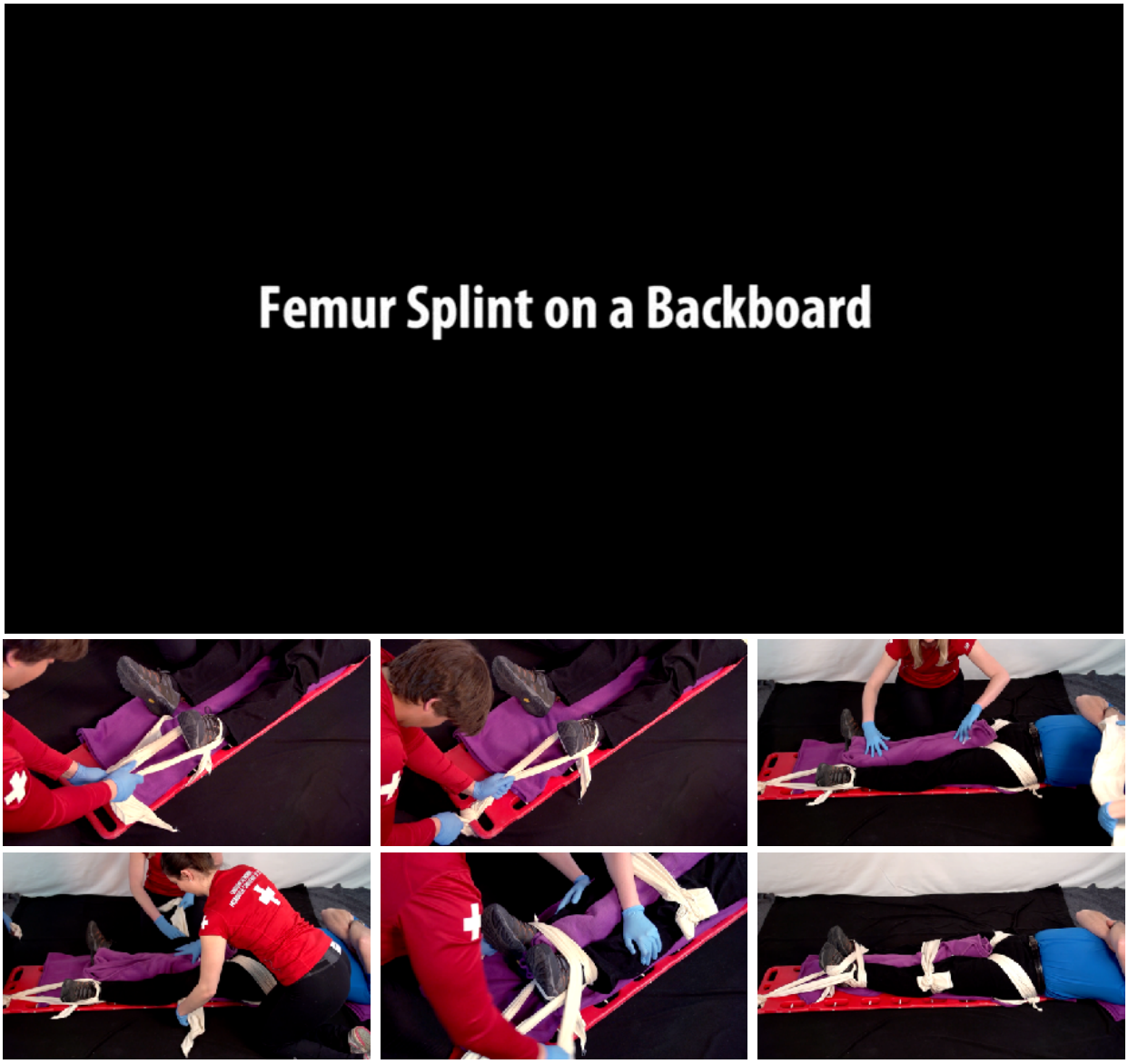


Figure 15-10: Femur fracture.

The amount of pull required to realign the leg depends on the size of the patient and the degree of the injury. If manual traction is going to be applied on a slope, ensure that both the patroller applying the counter traction, the patroller applying the traction and the patient are in a stable position that can be maintained until the splint is secured. When to start applying traction is a judgment decision based on the response time of appropriate splinting equipment to the site, the degree of injury, the ability of the patroller to maintain traction once applied and the pain/ physiological status of the patient.

If the fracture is displaced and the leg misaligned, re-alignment should be attempted prior to splinting. With both sides of the fracture site stabilized manually, apply a pull along the long axis of the bone (in its normal setting) first and then, move the distal end of the limb back into its normal position. If the leg has been rotated as part of the mechanism of injury, rotating the leg and foot back to its pre-injury position prior to splinting is appropriate.

Femur fractures

Signs and symptoms	Treatment
• swelling • instability of the leg, which may not be aligned properly • severe pain	1. Check distal PMS. 2. Roll the patient onto a backboard in a position to allow sufficient distance for the injured leg to have the stirrup bandage secured to the board, providing in line traction. The patient's head may extend beyond the upper end of the board and require support during the application of traction and transport. Cardboard splints under the patients back and head may be one option to provide patient comfort. 3. On each leg, use a single broad bandage. Secure one end to the backboard at a handhold above the patient's hip, pass it under the femur, up through the groin, over the top and tie it snugly to the same handhold. Do the same on both femurs. This forms a sit harness that prevents the patient from sliding along the board and provides an anchor point or counter traction for the traction that will be applied. 4. Apply a stirrup bandage to the lower leg on the affected side. Ensure that the stirrup bandage pulls on the distal tibia/fibula, not across the bones of the foot. 5. Apply traction along the long axis of the affected leg and secure the stirrup bandage to the foot end of the backboard. This is best accomplished with two patrollers to maintain traction while securing the stirrup bandage to the end of the backboard. Let patient comfort guide the amount of traction that is needed. 6. Secure the patient to the backboard for transportation, as required. Pad under the knees as needed. 7. Recheck distal PMS. 8. Transport to medical aid.

Femur injuries can result in major discomfort. Be aware that, due to internal bleeding, the patient's condition may deteriorate rapidly. Carefully monitor the patient's condition and treat as a Load and Go.

If the leg cannot be re-aligned (pain intolerance, physical resistance to re-alignment despite the application of manual traction, etc) splint the leg in the position it is found . Doing this successfully will require patroller ingenuity and the ability to improvise a workable splint solution.

The same technique can be used with bilateral (both) femur fractures. The goal is to restore the limb to a near-anatomical position. This will provide comfort and stability.

Monitor the patient constantly for signs and symptoms of shock as a result of internal bleeding into the thigh. Treat for open fracture if necessary.

Patella (knee cap)

The patella may be broken or dislocated by a direct blow or a fall on the knee, or by a strong sudden pull of the powerful thigh muscles, as in an attempt to recover from a slip.

The bone usually breaks transversely with considerable tearing of the surrounding soft tissue. In the case of a dislocation, the leg folds up like a jackknife. Commonly, due to swelling, the knee cannot be straightened and the leg must be splinted as found.

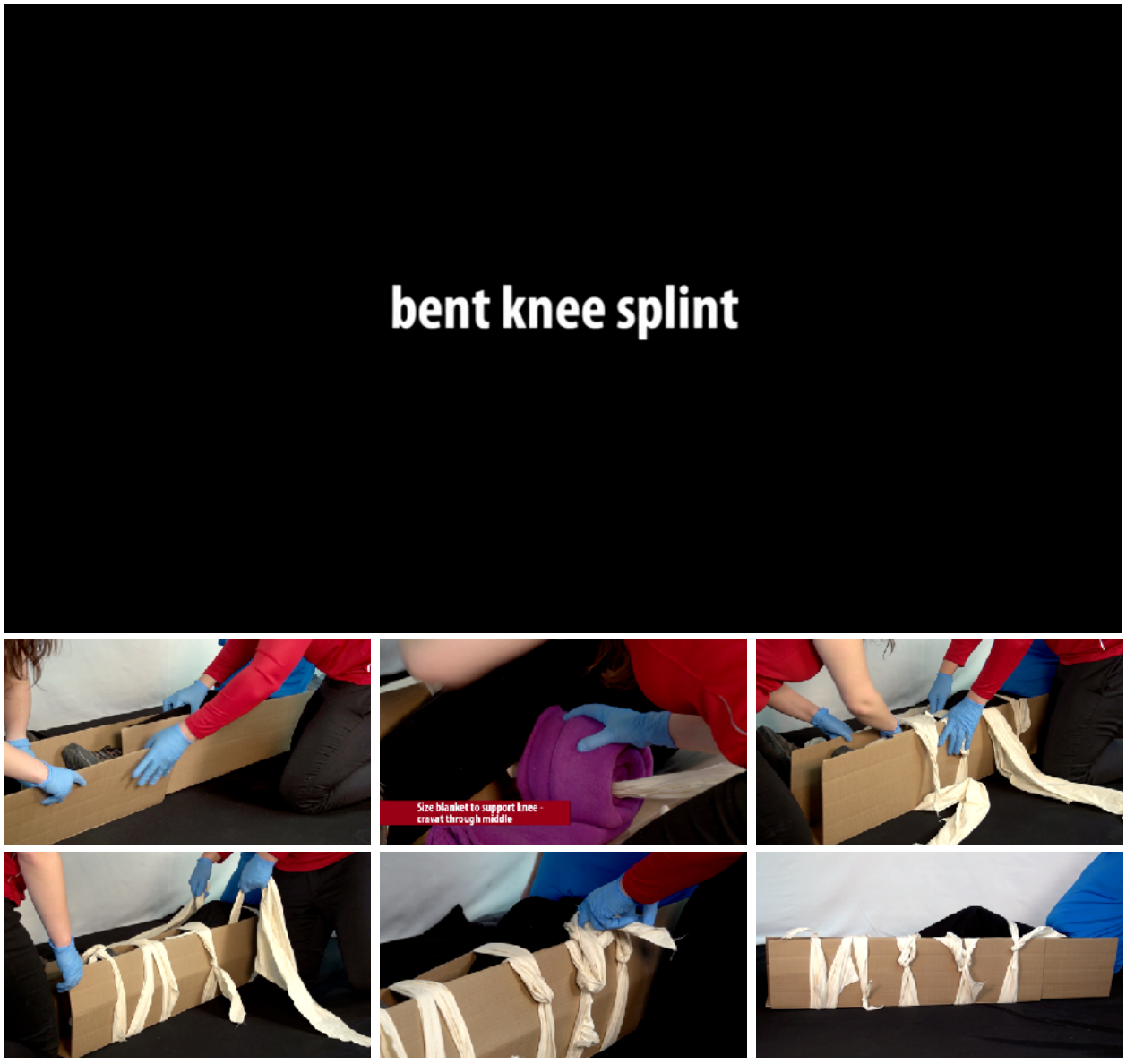
Patella (knee cap)

Signs and symptoms	Treatment

• intense pain at the location of the injury
• swelling,
• inability to straighten the leg or move the joint
• inability for the leg to bear the patient's weight
	1. Check distal PMS
	2. Have someone stabilize the injured leg.
	3. Prepare the first cardboard splint section by folding it lengthways into an L shape (4x2 panels).
	4. Slide the folded cardboard section into position, between the legs.
	5. Pad at the groin area.
	6. Fold a blanket or other material, ensuring that its width is the same as the width of the leg and the lower portion of the splint. This is important to maintain the integrity of the splint.
	7. Place a cravat bandage at one end of the folded blanket, then roll the blanket from the bandage end. This provides the support bandage for the knee.
	8. Place the roll alongside the knee and unroll it until its circumference fits snugly under the knee. Ask patient to provide feedback as to level of comfort achieved.
	9. Place the excess padding in the hollows and above the foot.
	10. Slide a second splint folded into an L shape into position on the outside of the leg. This splint should extend up past the hip.
	11. If necessary, place a third cardboard splint folded into an L shape to extend the outside of the splint beyond both the hip and the foot.
	12. Slide bandages in from the end of the splint to minimize any movement.
	13. Place bandages at the thigh, just below the knee, and the foot.
	14. Tie the bandages on the outside of the splint in the following order:
	  • at the thigh
	  • just below the knee
	  • figure-of-eight bandage at the foot. This may require two cravats depending on splint.
	  • The support bandage at the knee should not pull up on the knee, but be tightened to a level of comfort indicated by the patient
	15. Check distal PMS.
	16. Do not elevate the splint.

Stabilize in a straight line if possible. Commonly, due to swelling, the knee cannot be straightened and the leg must be splinted as found. If the leg cannot be straightened, apply the bent knee splint.

Bent knee splint



Flg 15-11: Bent knee splint.

Lower leg

The tibia and fibula are side-by-side and extend from the knee to the ankle. Fractures of the upper end of the tibia may extend completely or partially across the bone or into the knee joint. Spiral fractures of the lower one-third of the tibia are a common skiing injury. Sometimes the fibula is not broken and acts as a splint, reducing deformity and shortening. Frequently, both bones are broken. In alpine skiing, a slow twisting force may cause a boot-top fracture if the bindings do not release.

Lower leg fractures

Signs and symptoms	Treatment
• deformity • swelling • severe pain • the inability to move the injured part	According to the nature and circumstances of the injury: 1. Have one patroller apply and maintain manual traction to gently align the leg to its anatomical position. Move the limb slowly. Tying a stirrup bandage around the ankle or lower leg will allow more effective application and maintenance of traction during splinting. 2. Check distal circulation, motor response and sensation. 3. Have one patroller support the leg on either side of the fracture by grasping the patient's pant leg and lifting slightly while the splint is slid into position under the leg. 4. Place padding at the groin and under the knee, if there is a hollow. 5. Place the bandages in the following positions while minimizing movement of the leg: a) a cravat bandage at the thigh, as close to the top of the splint as possible. This provides support for counter-traction. b) a cravat bandage on the lower thigh c) a cravat bandage above the fracture d) a cravat bandage below the fracture e) two cravat bandages tied together for a figure-of-eight at the ankle to maintain traction 8. Tie all bandages from the thigh down with reef knots on the outside of the splint. 9. Tie the figure-of-eight bandage around the ankle: a) Pass the ends up and around, crossing on top of the ankle, to retain traction, being careful not to put any pressure on the toe of the boot. 10. Continue around the splint, crossing underneath the boot and tying on top of the splint below the boot. Retain manual traction until the figure of eight bandage has been tied. 11. Recheck PMS (distal circulation, motor response and sensation). 12. Elevate the splint, if PMS is present.

Locating an injury

Locate the site of the fracture by palpating gently but firmly along the front of the lower leg searching for the painful or deformed areas. The limb is often numb immediately after the incident. Fractures of the lower end of either or both bones are called fractures of the ankle. This injury is frequently mistaken for a sprain until x-rayed: therefore, it should be splinted.

Lower leg

Figure 15-12: Lower leg stabilization.

Splints for lower leg injuries

Treating lower leg injuries may require improvising splints from commonly available ski-related gear.

Sun Valley splint

The Sun Valley splint is made of two boards connected along the bottom edge by canvas.

Foam padding lines the inside of both boards. The top edge is either notched and has a cord attached for lacing the splint, or some splints have straps and quick fasten clips.

Using the Sun Valley splint

1. Examine the leg as usual.
2. Check distal PMS
3. Apply traction, if required.
4. Open the splint so the splint lies flat.
5. Size the splint on the uninjured leg.
6. Slide the splint under the leg. The splint should extend beyond the sole of the boot.
7. Close the splint around the leg and fasten.
8. Ensure the closure system does not loosen during transport.
9. Check distal PMS
10. Elevate the splint (if the distal PMS are not compromised).

Modified Sun Valley splint

The Modified Sun Valley splint is similar to its predecessor. It has been modified to include a metal hinge. The splint can be used for lower leg fractures and for knee injuries where the knee cannot be straightened.

Using the Modified Sun Valley splint

1. Examine the leg as usual. Apply traction, if required **(do not apply traction to a knee injury)**.
2. Check distal PMS
3. Open the splint and loosen the wing nuts so the splint lies flat.
4. Slide the splint under the leg, using the same technique as for the cardboard splint, with the cord toward the upper body. The splint should extend past the sole of the boot.
5. If the knee is bent, shape the splint to conform to the leg.
6. Tighten the wing nuts securely to hold the splint in this shape.
7. Close the splint around the leg and hold firmly together. Lash the splint together with the cord or fasten the straps, depending on the type of splint being used.
8. Check the distal circulation and sensation.
9. Do not elevate the splint.

Figure 15-13: Sun Valley and modified Sun Valley splints.

Foot and ankle

Fractures of these bones may be caused by crushing or rotating forces. Stabilize foot and ankle fractures in the position of comfort.

A pillow, blanket or a cardboard splint will provide adequate stabilization.

Figure 15-14: Foot and ankle stabilization

16. Medical conditions

Learning outcome:

Recognize, understand, and explain the treatment of common medical conditions.

Upon completion of this chapter you should be able to:

1. Recognize the signs, symptoms and explain the treatment for the medical conditions found in this chapter.
2. Demonstrate the treatment for the conditions found in this chapter.

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Anaphylaxis

Anaphylaxis is caused by a rapid and severe allergic reaction that usually involves more than one part of the body. The reaction can be serious enough to kill. It can be triggered by various things such as asthma or allergies to latex, insect stings, or to certain foods such as nuts, some types of fruit, fish and sometimes spices.

Signs and symptoms of anaphylaxis

- respiratory distress (wheezing)
- rapid breathing and pulse
- throat tightness and closing
- difficulty swallowing
- dizziness
- faintness and unresponsiveness
- cool and clammy skin
- swelling
- vomiting
- red watery eyes
- abdominal cramps
- diarrhea
- tingling feeling in the lips of mouth
- itchy rash
- sense of doom

A person who is known to suffer severe allergic reactions may be wearing Medic Alert identification.

Treatment for anaphylaxis

Epinephrine (adrenaline) is one of the drugs that will work against the deadlier effects of chemical substances released in anaphylaxis. For serious attacks, it is a vital treatment. During a potentially life-threatening allergic reaction, there is no reason epinephrine should not be used. Special injector (syringe) kits, such as the EpiPen® or ALLERJECT®, are available and carried by most patients who have a history of anaphylaxis. Both kits contain a disposable, pre-filled injection device that is used to administer epinephrine in the event of a severe allergic reaction.

Caution

Epinephrine is both a vasoconstrictor and a bronchodilator. In certain cases it can be extremely dangerous. The vasoconstriction effect is required to control the rapid onset of shock (without the presence of bronchospasms) caused in certain individuals by a severe allergic reaction. The severity of the shock varies according to the type of allergen and the person. If you accidentally inject yourself with a dose, you may now become a Load and Go patient. Consult the emergency services immediately. It is impossible to know how you will react to the injection. You may experience a vasoconstriction causing necrosis. If you injected yourself in a finger, toe, penis or nose you could potentially lose it. In addition, you may have infected yourself with a tainted needle (see Infectious Diseases in Chapter 3).

The injectors are available in two dose strengths:

- Adult dose for adults and children weighing 30 kg and more, delivers 0.3 mg epinephrine
- Child dose for children weighing between 15 kg and 30 kg, delivers 0.15 mg epinephrine

An injection should be given when:

- there is evidence of a general systemic reaction
- there is evidence of progressive clinical deterioration, or
- death seems imminent

General treatment

1. Activate EMS.
2. Assist the patient to administer the injection in the outer thigh muscle (no other area) (See EpiPen administration and ALLERJECT administration below).
3. Monitor vital signs closely.
4. Administer oxygen if available.
5. Be prepared to assist ventilations and perform AR (see Artificial Respiration (Rescue Breathing) in Chapter 6).
6. Treat for shock.
7. Arrange for transport to medical aid. The used injector should be sent with the patient for proper disposal at a medical facility. This will also show the medical personnel what medication has already been administered.

After assisting with the administration of the first dose, you should remain available to reassess and assist the patient as needed.

In some cases, a second dose of epinephrine may need to be administered. Many patients will carry a second dose that you can assist with administering. A second dose can be given as early as five minutes after the first dose if there is no improvement in signs and symptoms. Do not administer a second dose if signs of improvement are present.

If ABCs are compromised, treat and transport as a Load and Go.

EpiPen administration

Figure 16-1: Child (green) and adult (yellow) EpiPen devices

Assist the patient with the administration of EpiPen as follows:

1. Remove the EpiPen auto-injector from the carrier tube.
2. Have the patient firmly hold the EpiPen with the orange tip pointing downward.
3. Remove the blue safety cap.

4. Have the patient place the orange tip against their mid outer thigh at a 90-degree angle to the skin and ensure there is nothing under the clothing that will obstruct the needle injection.
5. Have the patient swing and push the orange tip firmly into their mid outer thigh until you hear a click.If necessary, you may assist the patient by placing your hand over the patient's wrist to help with the swing.Keep the hands clear of the orange end where the needle comes out.Holding the patient's wrist will also help in keeping the needle in place if the patient reacts to the injection and attempts to withdraw their hand.
6. Hold the EpiPen against the thigh for at least three seconds.
7. When the EpiPen auto injector is removed, the orange needle cover automatically extends to cover the injection needle.
8. Massage the injection area for 10 seconds.

For further information on how the EpiPen is administered view the videos at https://www.epipen.ca/how-to-use-epipen

ALLERJECT administration

The ALLERJECT device provides voice instructions for its use. The devices are dispensed with either English or French voice instructions.

Assist the patient with the administration of ALLERJECT as follows:

1. Pull the ALLERJECT auto-injector from the outer case. This will cause the voice instructions to begin automatically. Follow the voice instructions.
2. If the patient is ready to use the ALLERJECT, remove the red safety guard and place the device in the patient's hand. Do not touch the black base of the auto-injector where the needle comes out. If the patient is not ready to use the device put it back inside the outer case.
3. Have the patient place the black base against the middle of their outer thigh at a 90-degree angle to the skin and ensure there is nothing under the clothing that will obstruct the needle injection.
4. Have the patient firmly press the black base against the thigh until you hear a click and the hiss of the injection. If necessary, you may assist the patient by placing your hand over the patient's wrist to help with the injection. Holding the patient's wrist will also help in keeping the needle in place if the patient reacts to the injection and attempts to withdraw their hand.
5. Hold the ALLERJECT against the thigh for at least five seconds.
6. When the ALLERJECT auto injector is removed, the black cover automatically extends to cover the injection needle.
7. Massage the injection area for 10 seconds.

For further information on how the ALLERJECT is administered view the videos at https://www.allerject.ca/why-allerject?lang=en

Figure 16-2: Child (blue) and adult (orange) ALLERJECT devices.

For information only

[A CSP Regular Member (Advanced First Aid (AFA) certified) is not trained in these procedures]

While it is the most important medication to use in an emergency, epinephrine (adrenaline) may be rapidly metabolized in the body and lose its effectiveness. A second dose may be needed. Some self-administration kits now include a second dose as part of the standard set and patients may also carry a second separate dose. Another option for longer-term stabilization to be considered by a person who is properly certified and trained in this area (not a CSP AFA-certified member) is the co-administration of an antihistamine, particularly when access to advanced care is likely to be delayed more than two hours or in remote areas.These are far less effective than epinephrine in the emergent case, but longer lasting. An example of a fast-acting and long-lasting antihistamine is cetirizine (brand name Reactine and others), and it has the additional advantage of being non-sedating. An older and well-known option is diphenhydramine (Benadryl), but it is slower acting and sedating.

Asphyxia

Asphyxia is suffocation due to decreased oxygen and increased carbon dioxide in the blood. This causes respiratory arrest. Asphyxia can be due to trauma such as airway problems or blunt trauma to the chest. Non-trauma cases can be drowning, suffocation due to lack of air, or lack of oxygen in the air.

Signs and symptoms

- a bluish tint (cyanosis) or a very pale appearance to the skin and lips
- a deteriorating level of consciousness

Treatment

1. Remove the patient to an area of clear air immediately.
2. Establish an airway and administer oxygen, if available.
3. Begin assisted ventilations or artificial respiration if required.
4. Monitor the patient.
5. Activate EMS and treat as a Load and Go.

Asthma attack

Asthma is caused by an acute reactive constriction of the bronchi. In the late stages, this causes swelling of mucous membranes in the bronchial walls and the plugging of the bronchi by thick mucus secretions. An asthma attack may be triggered by allergic reactions, respiratory infections, emotional stress, cold weather or exercise.

Signs and symptoms of asthma attack:

- whistling or high-pitched wheezing during respirations
- anxiety
- over-inflated chest
- shallow, rapid respiration
- increased pulse rate
- coughing

The patient may also:

- breathe through pursed lips, as if sucking in air through a straw
- appear to be air hungry
- use accessory neck muscles to assist breathing
- prefer sitting forward

Treatment for asthma attack:

1. move the patient away from things that may be triggering the attack, such as smoke or dust
2. move the patient to a comfortable position (usually sitting), and loosen any restrictive clothing
3. reassure the patient
4. maintain an open airway
5. be prepared to assist breathing

6. administer high-flow oxygen, if available and local regulations allow
7. assist the patient in taking their medication (if their own inhaler is available and you are familiar with the commonly used inhaler devices and if local, provincial or territorial regulations allow).
8. if the patient is markedly recovered with the use of medication, recommend the patient seek further medical aid if required
9. if the patient has no inhaler, or the inhaler is ineffective, or the patient is experiencing severe breathing difficulties (change in mental status, slow and less noisy breathing), activate EMS and continue to observe and assist the patient until EMS arrives.

People with asthma may use a variety of delivery devices (commonly referred to as inhalers or puffers) to deal with the onset of an asthma attack. The most common example of this is the blue Metered-Dose Inhaler (MDI) called Ventolin (salbutamol). Another device that is becoming more prevalent for asthma treatment is a red Symbicort Turbuhaler®(budesonide/formoterol).

Figure 16-3: Ventolin inhaler (left) and Turbuhaler®(right).

People who carry inhalers are quite familiar with how to use them. However, in an urgent situation you may need to assist someone with the delivery of their medication by finding their delivery device and handing it to them.

Note: It is preferred that a metered dose inhaler be used with a spacer device when available.

For further information on how a metered-dose inhaler is used without a spacer view the video at https://www.lung.ca/lung-health/get-help/how-use-your-inhaler/mdi-no-spacer

or with a spacer at https://www.lung.ca/lung-health/get-help/how-use-your-inhaler/mdi-spacer-adult

For further information on how a Turbuhaler®is used view the videos at: https://www.lung.ca/lung-health/get-help/how-use-your-inhaler/turbuhaler%C2%AE?_ga=2.154109886.768271341.1613947365-1631800231.1613947365

Cardiovascular disease

Cardiovascular disease is a class of diseases that involve the heart or blood vessels. Cardiovascular disease includes coronary artery diseases such as angina and myocardial infarction (commonly known as a heart attack). Other cardiovascular diseases include stroke, heart failure, and a number of other conditions that are not covered in this manual. Coronary artery diseases and stroke involve atherosclerosis, the progressive nature of which is illustrated below.

Atherosclerosis

Atherosclerosis is the most common and most important type of arteriosclerosis, also called hardening of the arteries. The result can be a harmful clot in the blood that may cause a heart attack or stroke or disease of the peripheral blood vessels. It is generally agreed that the process begins when the inner layer of a blood vessel becomes injured. Some factors that cause mechanical damage to the blood vessel are high cholesterol and triglycerides, high blood pressure and tobacco smoke. Once damage has occurred, platelets, cholesterol other cells, fat and debris accumulate over time in the damaged area and form a fatty plaque. The bigger the plaque, the more it affects the area through which the blood flows, decreasing the oxygen supply to the body's organs. If blood flow is cut off to the heart, this can cause a heart attack. If

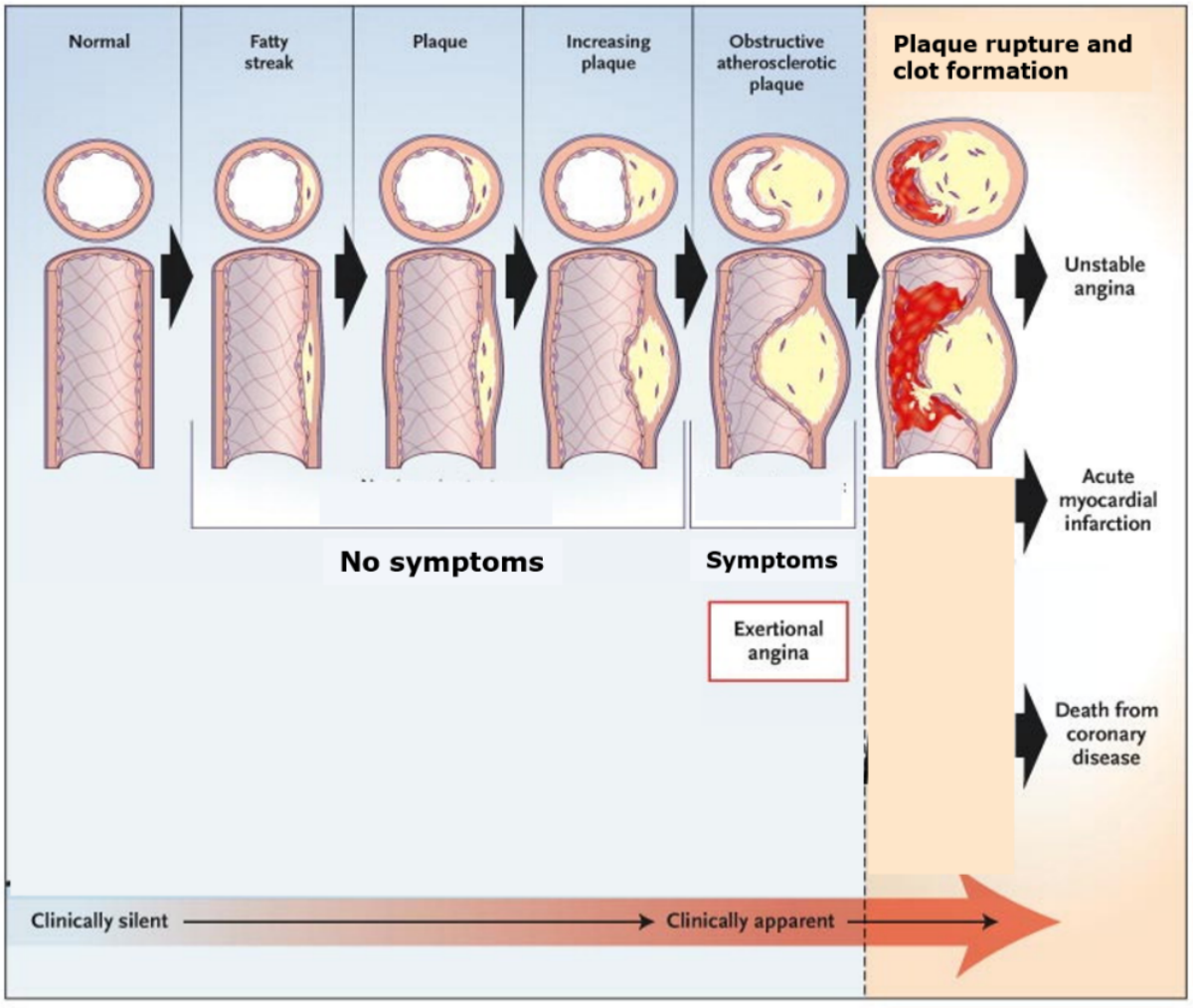

Figure 16-4: Progressive nature of coronary atherosclerosis.

the blood supply to the brain is blocked, a stroke may result. If blood flow to the extremities is stopped, gangrene may occur.

Atherosclerosis typically does not produce symptoms until the blood vessel's diameter has been decreased by 70 to 80 percent. Angina (anginapectoris), or chest pain brought on by exertion, can be caused by this blockage.

Acute (sudden) events, such as a heart attack, stroke or sudden death, are often caused by the rupture of plaques that decrease the blood vessel diameter by 50 percent. The plaque rupture releases chemicals that aid in coagulation. This leads to the formation of a clot on top of the pre-existing fatty plaque. As a result, the slow accumulating process of atherosclerosis, if severe, may cause symptoms such as angina pectoris, but the life-threatening events, such as heart attack or stroke, are usually associated with sudden plaque rupture on top of an already narrowed blood vessel.

Angina

Angina is pain resulting from a deficient blood supply – and therefore oxygen – to the heart muscle. If coronary artery disease is present, the narrowed arteries cannot provide the increased requirement for blood. The heart muscle then becomes starved for oxygen, which may cause chest pain. Angina can be triggered by strenuous physical activity, emotional stress, heavy meals, extreme cold or hot weather.

Angina pain usually eases or disappears if the patient rests. Generally, angina attacks do not last for more than 15 minutes after the stress stops. It is that fact which distinguishes an angina attack from a heart attack. Frequently the patient will have had previous episodes, and may be on medication.

Signs and symptoms of angina:

The signs and symptoms of an angina attack may vary from one person to another, but will normally be the same for one person:

- sub-sternal pain, which may start suddenly or build up gradually
- pain is usually described as moderate to heavy pressure or squeezing
- pain may vary from just a discomfort to very severe
- pain may radiate across the chest, into the left or right arm, up into the neck or jaw, or into the back
- may show as a feeling of indigestion
- pain usually lasts 5 minutes, rarely more than 15 minutes.
- pain is relieved within 5 minutes by rest, medication, or both
- pain will not be influenced by changing the rate of respiration, coughing or movement

If there is a change in this person's signs and symptoms, a heart attack should be suspected.

Treatment for angina:

1. If the patient is diagnosed with angina and has medication available, assist the patient in taking it if local regulations allow. (See"Angina medication instructions"below).
2. Keep the patient at rest.
3. Give oxygen, if available.
4. Take a medical history.
5. Check for MedicAlert identification.
6. Evaluate vital signs.
7. Monitor vital signs during transportation.

8. If the patient does not improve with medication, or shows signs of getting worse, activate EMS and treat as a Load and Go.
9. Be prepared to treat the patient if they lose consciousness.

Angina medication instructions

Angina patients use nitroglycerin, also known as glyceryl trinitrate (GTN), as medication. It comes in three different delivery options:

- transdermal patches or topical ointment deliver nitrates through the skin
- sublingual pills held under the tongue
- sublingual spray applied on or under the tongue.

Care must be taken when examining any patient having a suspected heart attack that you do not accidentally roll their patch and come in direct contact with the medication. A transdermal patch will likely be attached already to the patient's skin near the shoulder on either the chest or back. The standard practice of using gloves will ensure that you do not come into contact with the patient's medications.

It is important to note that the patient should not administer more than three doses of either pills (placed directly under the tongue) or sprays (as directed) over a ten-minute period. The patient must not take their medication if the patient has used erectile dysfunction pills such as Viagra, Levitra or Cialis within the last 24 hours. In addition, the medication should not be administered if:

- the pulse rate is less than 50 or greater than 150
- systolic blood pressure is less than 100 mmHg
- the patient is pregnant
- the patient is allergic to nitrates
- the pain is of traumatic origin.

Heart attack

A heart attack, also called a myocardial infarction (MI), occurs when circulation to a part of the cardiac muscle becomes impaired, resulting in an inadequate oxygen supply. The cardiac muscle may lose its ability to function effectively.

Signs and symptoms of a heart attack:

Heart attack symptoms vary from person to person, or even from one heart attack to another for the same person. Symptoms may show up in different ways and can depend on a number of factors, such as gender, age and pre-existing disease.

Early symptoms of a heart attack can include the following:

- mild pain or discomfort in the chest that may come and go
- pain in the shoulders, neck and jaw
- sweating
- nausea or vomiting
- light headedness or fainting
- breathlessness
- feeling of "impending doom"
- severe anxiety or confusion.

The severity of the signs and symptoms vary and can lead to denial about the possibility of a heart attack. The pain may have occurred when the patient was resting or during physical or emotional exertion.

The patient's face may be pale and ashen and the skin may have a bluish tint(cyanosis).

Signs and symptoms of a heart attack in men:

Men are more likely to experience a heart attack than women, and to have them earlier in life.

Symptoms of a heart attack in men include:

- chest pain or pressure that feels like something heavy is sitting on the chest, with a squeezing sensation that may come and go or remain constant and intense
- upper body pain or discomfort, including arms, left shoulder, back, neck, jaw or stomach
- shortness of breath, which may feel like you can't get enough air even when resting
- rapid or irregular heartbeat
- stomach discomfort that feels like indigestion
- dizziness or feeling like you are going to pass out
- breaking out in a cold sweat.

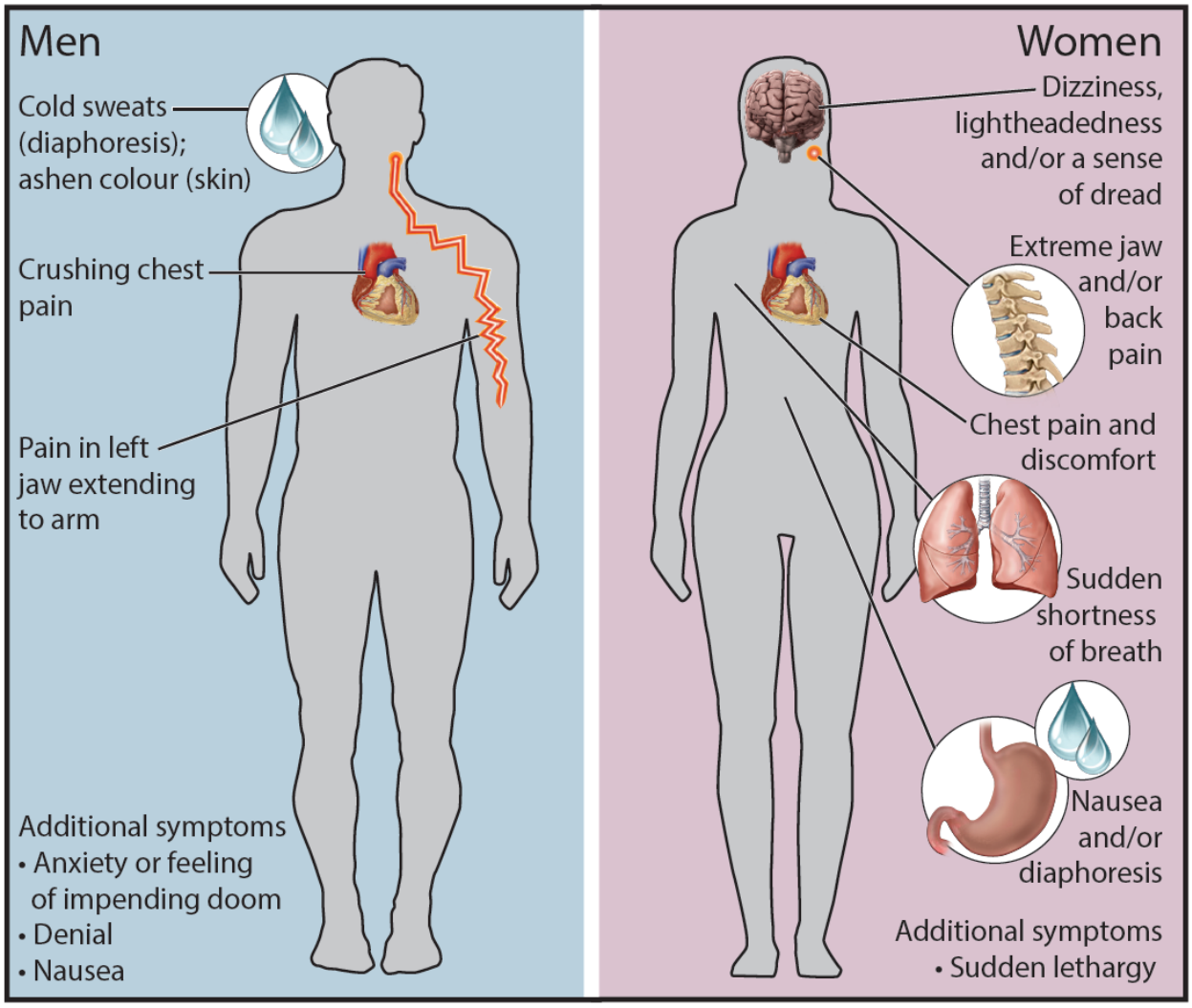

Figure 16-5: Male and female experiences of heart attacks

Signs and symptoms of a heart attack in women:

Heart attack symptoms can be quite different for women than men. As with men, women's most common heart attack symptom is chest pain or discomfort; however, women can experience a heart attack without chest pressure. Women are more likely than men to experience some of the

other common symptoms that are unrelated to chest pain, such as shortness of breath, unusual fatigue, sleep disturbances and anxiety.

These symptoms may be vague and not as noticeable as the crushing chest pain often associated with heart attacks in men. Women tend to have symptoms more often when resting, or even when asleep, then they do in men. These symptoms may be experienced for more than a month before the heart attack occurs. Because women don't always recognize the symptoms as those of a heart attack there is a tendency to seek medical attention after heart damage has occurred.

Symptoms of a heart attack in women include:

- pressure or pain in the centre of the chest, which may spread to the arms
- unusual fatigue lasting for several days or sudden severe fatigue
- sleep disturbances
- anxiety
- light headedness
- shortness of breath
- pain in one or both arms
- indigestion or gas-like pain
- upper back, shoulder or throat pain
- jaw pain or pain that spreads up to the jaw

There are additional symptoms of a heart attack that women over the age of 50 (post menopause) may experience. These symptoms include:

- severe chest pain
- pain or discomfort in one or both arms, the back, neck, jaw or stomach
- rapid or irregular heartbeat
- sweating.

Signs and symptoms of a silent heart attack:

A silent heart attack is like any other heart attack except that it occurs without the usual symptoms. Silent heart attacks are more common among people with diabetes and in those who have had previous heart attacks.

Symptoms that may indicate a silent heart attack include:

- mild discomfort in the chest, arms or jaw that goes away after resting
- shortness of breath and tiring easily
- sleep disturbances and increased fatigue
- abdominal pain or heartburn
- skin clamminess.

After having a silent heart attack the person may experience more fatigue than before or find that exercise becomes more difficult.

Treatment for a heart attack:

If a heart attack is suspected, EMS should be activated immediately and treated as a Load and Go. Further treatment depends on whether the patient is conscious or unresponsive.

If the patient is conscious:

1. While waiting for EMS to arrive, the patient should take a single oral dose of chewable aspirin. You may assist the patient to take their own medication or provide the aspirin if local regulations allow. (See "Aspirin administration" below).
2. Get an automated external defibrillator and keep it close to the patient in case it is needed.

3. Help the patient get into in a position of comfort (usually semi-sitting) and transport to medical aid.
4. Do not allow the patient to exert themselves in any way.
5. Give oxygen, if available.
6. Keep the patient calm and still.
7. Loosen restrictive clothing.
8. Take a medical history.
9. Check for MedicAlert identification.
10. Evaluate and continue to monitor vital signs.
11. Keep the patient warm, but do not overheat.
12. Be prepared to treat the patient if they lose consciousness. (See “If the patient is unresponsive” below).

Aspirin administration

Taking ASA (acetylsalicylic acid) within the first four hours of a heart attack can reduce a person’s risk of fatality by 25 per cent. ASA works by reducing the tendency of blood platelets to clump and clot, thereby decreasing the possibility of artery blockage.

Time is of the essence in treating heart attacks. Given the environment in which some patients are found, medical help is not always readily available. Aspirin (one of the most common brands of ASA) is one of the most cost-effective ways to treat heart attacks.

Administering Aspirin or an ASA product is **not** permitted if any of the following conditions exist:

- the patient is already taking blood thinning medication such as warfarin/Coumadin
- signs and symptoms indicate a possible stroke
- the patient has a recent history of gastrointestinal bleeding
- the patient takes an Aspirin or ASA product regularly and has just taken the recommended dose
- local, provincial or territorial regulations do not allow patrollers to administer Aspirin or ASA products

Administering Aspirin or an ASA product, obtained from a reliable source, is only permitted when you suspect a heart attack and the five following conditions are present:

The patient is:

- conscious and alert
- able to provide an accurate medical history
- able to chew and/or swallow the medication
- not allergic to Aspirin or ASA products
- not asthmatic

If all the above conditions are met:

1. Check for MedicAlert identification.
2. Ask questions concerning allergies or chronic respiratory conditions.
3. If available and upon consent of the patient, the patient should chew either two 81 mg ASA or one regular adult strength 325 mg ASA tablet.

4. Monitor and communicate the patient's response to the medication and any possible complication.
5. Continue to be available to assist the patient with the use of their own medication.

Patrollers may not recommend the use of Aspirin or ASA products in any other circumstance, for example headache, or sprains and strains. However, you may assist an individual in taking their own medication, for example by providing an accompanying drink of water.

Areas may decide to pack Aspirin or ASA products with the oxygen and/or trauma packs. Aspirin and ASA products may also be available at area clinics but such storage must adhere to all local regulations and provincial or territorial legislation.

If the patient is unresponsive:

1. Establish and maintain an airway.
2. Loosen restrictive clothing.
3. Administer oxygen, if available.
4. Provide AR and CPR if needed (see Basic Life Support in Chapter 6).
5. Activate EMS and treat as a Load and Go.

Heart failure

Heart failure, also called congestive heart failure, is a condition that develops after the heart becomes damaged or weakened. Heart failure occurs when the pumping action of the heart is not strong enough to move blood around, especially during increased activity or under stress. In addition, the heart muscle may not relax properly to accommodate the flow of blood back from the lungs to the heart. These abnormalities in heart function may cause fluid to back up into the lungs and in other parts of the body, such as the ankles. The congestion in the lungs and lack of oxygen may make a person feel tired and short of breath. Sometimes the fluid in the lungs can accumulate to the point where it can cause a life-threatening condition called acute pulmonary edema, requiring emergency treatment.

Heart failure has many causes or underlying risk factors. The most common is damage to the heart muscle caused by a heart attack. The second most common cause is high blood pressure(hypertension), which, if left untreated for a long period, can lead to heart failure. Less common causes include:

- heart valve disease
- infection causing inflammation of the heart muscle
- excessive use of alcohol or drugs
- diabetes
- being obese or overweight
- high blood cholesterol
- heart muscle disease of unknown causes
- other medical conditions such as anemia or thyroid diseases.

Congestive heart failure is on the rise as more people survive heart attacks and other acute heart conditions. Heart failure is a serious condition with no cure. However, with lifestyle changes and treatment options the condition can be managed.

Stroke

A stroke, also called a cerebral vascular accident (CVA), is the result of a reduction in the supply of blood to a section of the brain due either to blockage or rupture of the artery supplying the area.

A warning sign of a possible future stroke is a “mini-stroke” known as a transient ischemic attack (TIA). Signs and symptoms of a TIA are similar to a stroke, but they disappear spontaneously within minutes or hours. The most common are visual disturbances, headache, brief episode of speech disturbances, clumsiness, dizziness and/or nausea.

Signs and symptoms of a stroke:

The signs and symptoms depend upon where the brain damage has occurred, but may include:

- one side of the face is without muscle tone and will appear flaccid or drooping
- reduced muscle power or paralysis on one side of their body
- unable to talk or has slurred speech
- confused, or unable to express themselves by gesturing or by writing
- pulse quite strong, though slow
- on examination, one pupil may be dilated in comparison to the other

The patient may have a history of:

- high blood pressure (hypertension)
- short duration fainting spells
- “mini-strokes”, or TIAs
- headaches
- periods of dizziness
- visual disturbances
- vomiting

Treatment for stroke:

Appropriate treatment depends upon whether the patient is conscious or unresponsive.

If the patient is conscious:

1. Maintain an open airway.
2. Administer oxygen, if available.
3. Reassure the patient.
4. Keep the patient calm.
5. Monitor vital signs.
6. Activate EMS and treat as a Load and Go.
7. Give nothing by mouth.

If the patient is unresponsive:

1. Maintain an open airway.
2. Administer oxygen, if available.
3. Monitor vital signs.

4. Activate EMS and treat as a Load and Go.

Remember FAST		
F	Facial drooping	A section of the face, usually only on one side, that is drooping and hard to move. This can be recognized by a crooked smile.
A	Arm weakness	The inability to raise one's arm fully.
S	Speech difficulties	An inability or difficulty to understand or produce speech.
T	Time	If any of the symptoms above are showing, time is of the essence; call the emergency services or go to the hospital.

Diabetic emergencies

Diabetes is a disorder which affects the body's ability to regulate the level of blood sugar (glucose). All body cells require glucose for their functioning (see Cells in Chapter 2). The use of glucose by the cells is controlled by insulin, which is a hormone produced by the pancreas. Insulin allows glucose to move from the blood stream into the cells where it is then used to produce energy. When there is too much insulin in the blood stream or not enough glucose, the energy within the cells becomes depleted, and they begin to malfunction. On the other hand, if the body cannot produce enough insulin, cells are unable to take up and utilize the glucose.

Approximately one in 20 Canadians has diabetes.

People with diabetes have an increased risk of heart disease, arteriosclerosis of the blood vessels (a buildup of plaque in the inner lining), high blood pressure, stroke, kidney damage, impaired vision, and infections.

The complications of diabetes are usually related to the patient's inability to control their blood sugar level. The control of diabetes consists of diet, exercise and medication or insulin injections. An imbalance of these factors may lead to either of the two diabetic emergencies: hypoglycemia and hyperglycemia, described below.

Hypoglycemia (low blood sugar)

Hypoglycemia, or low blood sugar level, is the most common complication of insulin use, and is extremely dangerous. The signs and symptoms appear quite similar to those of shock.

Excess insulin or a lack of food intake leads to the rapid onset of hypoglycemia over a period of minutes or hours. With too much insulin in the blood stream, glucose moves so rapidly out of the blood and into the body cells that there is insufficient glucose left to maintain normal brain function. Treatment must be rapid, since the brain cannot tolerate low glucose levels for long, and permanent brain damage or death can result if immediate emergency care is not provided.

Hyperglycemia (high blood sugar)

Hyperglycemia, or high blood sugar level, is the other serious complication of uncontrolled diabetes; it generally develops slowly, over a period of days, and is caused by a lack of insulin. Lack of insulin can cause the blood sugar level to become high, but the cells are not able to use the glucose. This forces the body to use fat as the main energy source, and causes an accumulation of a waste product in the blood stream.

Diabetes Summary of characteristics		
Characteristics	**Hypoglycemia**	**Hyperglycemia**
Blood Sugar	Severe low	Severe High
Potential causes	Excess insulin Skipping meals Vomiting Exercise without sufficient caloric intakeorinsulin adjustment Excess alcohol ingestion Emotional distress Illness	Insufficient insulin (missed doses) Inability to take medications and follow diet Infection Undiagnosed diabetes
Onset	Rapid (minutes to hours)	Slow (days)
Cardiovascular	Palpitations (forceful heart beats, or skipping a beat) Modest increase in blood pressure	Rapid weak pulse Decreased blood pressure
Respiratory	Unremarkable	Rapid deep breathing
LOC	Alert or unresponsive depending on severity	Alert or unresponsive depending on duration and severity. Coma in severe cases
Central nervous systemsigns and behaviour	Confusion or disorientation Poor coordination Combative or hostile Slurred speech Swelling of the tongue Seizures (if severe)	Confusion Irritated or agitated
Neuromuscular	Tremor, shaky hands	Weakness (may be one sided)
Skin	Pale, cold, sweaty (“clammy”)	Flushed, warm dry
Breath odour	Unremarkable	Fruity, apple cider, acetone (nail polish remover)
Other	Hunger Headache Tingling or numbness of lips andmouth	Fatigue Nausea Thirst (may be extreme) Frequent urination Dehydration Abdominal pain

Over time, hyperglycemia can damage many of the organs of the body. To function normally, a person with diabetes should regulate their sugar intake or supplement the lack of insulin by the use of a stimulant to increase insulin production (medication), or by the use of external insulin, i.e., insulin injection.

The hyperglycemic patient is usually dehydrated and confused, and looks quite different from those with hypoglycemia.

Treatment for hypoglycemia

If the patient is alert, urge the patient to eat and drink as quickly as possible. People with diabetes often recognize their own symptoms of low blood sugar and are able to treat themselves. Many are equipped with a glucometer to measure their blood sugar levels to confirm that they are low.

Recommend the patient seek further medical aid. Some people with diabetes wear a pump on a belt to provide a constant infusion of insulin through a needle placed in the abdominal wall.

For symptomatic hypoglycemia in conscious adults, children and infants:

1. Check for MedicAlert identification.
2. Assist the patient to take 15g to 20g glucose tablets or gel tube. A person with diabetes may carry their own glucose tablets or prepackaged gel tubes. If glucose tablets or gel tubes are unavailable alternate forms of dietary sugar may be used, see below.
3. Repeat glucose administration if symptoms continue after 15 minutes.
4. Monitor vital signs.
5. Arrange transportation to medical aid.

If the patient becomes unresponsive, or an unresponsive patient has a MedicAlert that indicates they are a diabetic, or they have an insulin pump or glucometer patch, activate EMS and treat as a Load and Go. Follow the General treatment for the unresponsive patient at the end of this chapter.

Alternate sources of dietary sugar:

- fruit juice or non-diet soda pop
- candy, e.g., jellybeans, Lifesavers, Mentos
- honey
- granulated sugar (packets, teaspoons or cubes)
- dextrose

Treatment for hyperglycemia

Arrange for transportation to medical aid.

If it is unclear whether the patient is hyperglycemic or hypoglycemic, treat for hypoglycemia.

Summary of diabetes considerations

- Although diabetes is common, the two major complications, hypoglycemia and hyperglycemia, are less common.
- When in doubt, give sugar. A little extra sugar will do no further harm if sugar levels are already high, but may save a life if they are low.
- Do not assist the person with diabetes to take their insulin shot. This may be the wrong treatment.
- The majority of people with diabetes are very well informed about their condition. Many are equipped with a device to measure their blood sugar levels.
- Most people with diabetes know how to handle imbalances in their blood sugar.

Autonomic dysreflexia

A patient with a spinal cord injury (SCI) may be at increased risk for Autonomic dysreflexia. This condition may be chronic or the result of a new injury superimposed on a situation such as a full bladder, kinked catheter, impacted bowel, hypothermia, or other physiological stressors such as skin lesions, blisters, frostbite, in-grown toenails, tight or constrictive boots or clothing. These factors may trigger an inappropriate release of noradrenaline, a hormone that raises blood pressure by constricting blood vessels. Autonomic dysreflexia to a patient with SCI is a medical emergency.

Signs and symptoms of autonomic dysreflexia:

- Initially, no symptoms may be detected even though present
- Increased feelings of panic or anxiety

- Rapid increase in blood pressure may cause headache and/or blurry vision
- Slower heart rate(<60 bpm)
- Flushing or sweating above the level of the SCI
- Sweating or shivering may not occur below the level of the SCI
- The loss of neural or electrical stimulation to organs or body parts, or innervation, may affect bladder and bowel function

Management

1. Recognize the symptoms.
2. Monitor vital signs.
3. Loosen restrictive clothing.
4. Remove any painful stimulus.
5. Search for the cause – check bladder and bowel problems first. If the patient is conscious, ask for his/her permission and assistance.
6. Treat the patient sitting up to avoid increasing intracranial pressure.
7. Treat the patient in warm and quiet surroundings if possible.
8. Prepare for rapid transport to a higher level of medical care.

Epilepsy (seizures)

Epilepsy is the physical manifestation of uncoordinated electrical activity in the brain that may also present with uncoordinated physical activity characterized as a “seizure”.

Seizures can be classified as:

- Focal onset (with or without awareness)
- Generalized onset
- Unknown onset (which may be later diagnosed as focal onset or generalized onset).

The nature of the seizure is determined by the location of uncoordinated electrical activity in the brain at the beginning of the epileptic event. They may further be described as motor or non-motor depending on whether uncoordinated muscle activity is also observed.

Focal seizures originate locally on one side of the brain and may include sensory or motor components. For example, if the origin is in the area of the brain in which sounds are processed (hearing), the person may have a perception of sounds that are not really there, but no abnormal muscular movement. If the origin is in the area responsible for muscular control of a local region e.g. arm, the abnormal muscular movement will be limited to that region.

Generalized seizures may originate locally but rapidly spread across both the left and right hemispheres of the brain to have widespread uncoordinated muscle activity and a loss of awareness.

Signs and symptoms of seizures:

Focal onset, aware seizure:

- Focal aware: The patient is responsive, conscious, and can recall what happens during the seizure event.
- Involvement may include motor activity resulting in sustained uncoordinated muscle contractions, uncoordinated movements, or loss of muscle tone however these are limited to one area.

- Involvement may also include or be limited to sensory: olfactory (smell), visual, auditory (hearing), or taste.

Focal onset impaired awareness seizure:

While any of the above may be manifested, the patient will have limited or no recall of the seizure event. The patient may also present an impaired or absent ability to speak, loss of visual focus and tracking, or even be unresponsive.

General onset seizure:

- Generalized seizures produce an altered level of consciousness and most often a loss of consciousness. There can be a slow recovery of normal consciousness that can be followed by using the AVPU scale found in Chapter 4. There is usually no recollection of the event.
- There may be a loss of bowel or bladder control, and involuntary bite that can lead to dental or tongue injuries. Pupil response may be abnormal both during the event and during recovery.
- There may be a temporary cessation of breathing, which can lead to associated physical findings e.g., cyanosis, and will need to be managed as impaired ventilation if persistent.
- Generalized seizures include involuntary muscle contractions that may be localized (but with altered level of consciousness), or generalized. “Tonic-Clonic” seizures refer to the repetitive contraction and relaxation of the involved muscle groups.
- In the recovery phase, fatigue and a desire to sleep are common and should be accommodated when possible.

Treatment of seizures:

1. Lay the patient down -even during a seizure- to prevent further injury.
2. Protect the patient from harm by removing any nearby sources of potential injury, but avoid moving the patient unless they are in immediate danger, e.g., they are in oncoming traffic.
3. Place soft padding under the patient’s head to protect it. Remove eyeglasses and loosen any restrictive clothing from around their neck. Do not restrain the patient.
4. When the seizure episode is over, check the patient’s breathing. If they are breathing normally, move them onto their side in the recovery position and ensure their airway is open. If they have irregular breathing, be prepared to provide artificial respiration (see Artificial Respiration in Chapter 6).
5. Check forMedicAlert identification and get additional information from available family members, caregiver, or friends.
6. If present, ask a family member or caregiver if the patient has any anti-seizure medication.
7. Activate EMS if the patient has hurt themselves, it is their first seizure, the seizure lasts for more than five minutes, or they have repeated unexpected seizures.
8. Note the start and stop time of the seizure, as well as if it reoccurs. Communicate this information to EMS.
9. Transport the patient to a medical aid facility with a record of vital signs, a description of the seizure, and a personal history, if possible.
10. Reassure the patient.
11. Protect the patient’s dignity. For example, move bystanders along and cover any signs of accidental urination.

12. If the patient is a baby or child, in addition to the steps above check the baby or child's temperature. If they are too hot, cool them by removing any excess clothing and expose them to fresh, cool air.

Never place any fingers or any other object in a patient's mouth during a seizure.

Status epilepticus:

Generalized seizures lasting more than five minutes are uncommon but do occasionally occur. This is known as status epilepticus. Be prepared to perform artificial respiration during relatively quiet intervals (Artificial respiration (Rescue breathing) in Chapter 6),.

Status epilepticus is a medical emergency. Treat it as a Load and Go.

Hyperventilation

Hyperventilation is the only breathing problem that is not a pre-hospital medical emergency. Hyperventilation often occurs in the wake of highly emotional or stressful situations, or due to pain or nausea. It can also occur for no obvious recognizable reason.

Hyperventilation involves breathing too quickly, to the point that the oxygen and carbon dioxide gases in the blood are altered from their normal balance, bringing on the symptoms discussed below. Treatment is aimed at calming the patient, in order to restore the patient's blood gases to normal.

Frequently this condition occurs in teenagers and young adults - an age group not generally as susceptible to the serious underlying causes of breathing problems as other age groups.

Signs and symptoms of hyperventilation:

- tingling and numbness in the hands and around the mouth
- deep, rapid respiration with rapid pulse
- marked anxiety, often escalating to panic
- dizziness, syncope
- fingers and hands drawn into a characteristic claw-like spasm called carpopedal spasm

Unlike many other respiratory ailments, the patient does not wheeze or make other abnormal breathing sounds. The symptoms often generate increased anxiety, making the syndrome a self-perpetuating cycle. Hyperventilation is not just breathing fast. Do not assume that all rapid breathing represents hyperventilation.

Do not treat hyperventilation with re-breathing (paper bag, hands cupped over face, etc.). It is contraindicated and therefore no longer used for this problem.

Treatment for hyperventilation:

1. Calm and reassure the patient.
2. Explain to the patient what is happening.
3. Help the patient slow their breathing by having them mimic your breathing as you start off quickly and gradually slow your own rate down.
4. If oxygen is available, you may administer it to the patient. This does not affect the hyperventilation, but may relieve other problems if the patient is not hyperventilating.

Syncope (fainting)

Syncope, also known as fainting, is a loss of consciousness and muscle strength characterized by a fast onset, short duration, and spontaneous recovery. Syncope is caused by a decrease in blood flow to the brain, typically from low blood pressure. Causes range from non-serious to potentially fatal, and fall into three broad categories:

- cardiac syncope (cardiovascular issues)
- reflex syncope (vasovagal syncope, situational syncope, carotid sinus syncope)
- orthostatic syncope

Cardiac syncope is the cause in about 10% of cases and is the most serious. Common causes of cardiac syncope include: arrhythmia and abnormal heart rhythm; aortic dissection; and, aortic valve stenosis. Cardiac syncope often occurs suddenly, without dizziness or other pre-syncope symptoms.

Reflex syncope is the most common cause of fainting and is the result of a reflex response to some trigger which causes the blood vessels to expand and the heart rate to decrease, resulting in a drop in blood pressure and reduced blood flow to the brain.

Vasovagal syncope - the common faint – is the most common form of reflex syncope. Some vasovagal syncope triggers include:

- seeing blood
- getting an injection or having blood drawn
- blood donation
- standing up quickly
- standing upright for a long time
- sudden and unexpected trauma, stress or pain, such as being assaulted

Situational syncope is a sudden reflex response to a trigger other than those listed above, including:

- coughing, sneezing, laughing, swallowing
- pressure on the chest after exertion or exercise
- defecating, urinating
- eating a meal
- sudden abdominal pain
- blowing a brass instrument or lifting weights

Carotid sinus syncope is a response in older adults that occurs when pressure is applied to the carotid artery in the neck. Triggers include: a hard twist of the neck, wearing a tight collar, and pressing on the carotid artery – do not press too hard when checking the carotid pulse!

Orthostatic (standing) syncope is due to a drop in blood pressure of 20 mmHg or more (hypotension) when standing up. This is often due to medications that a person is taking but may also be related to dehydration, significant bleeding or infection.

Signs and symptoms of presyncope:

Signs and symptoms before the loss of consciousness are known as presyncope and can last for a few seconds before the onset of vasovagal and orthostatic syncope. Presyncope presents recognizable signs and symptoms and a period during which rapid first aid treatment could improve symptoms or prevent syncope from occurring.

Treatment for presyncope:

1. Assist a person who is feeling faint (presyncope) into a safe and comfortable position, such as sitting or lying on the floor, so they cannot fall and to lessen the faint feeling.

Typical signs and symptoms of presyncope	
Signs	Pallor/paleness, sweating, vomiting, shivering, sighing, diminished postural tone, confusion
Symptoms	Faintness, dizziness, nausea, feeling warm/hot or cold, abdominal pain, visual disturbances (blurred vision, black spots)

2. While in a safe and comfortable position, a person feeling faint can perform physical counter pressure manoeuvres on their own to lessen the feeling and avoid syncope.
3. Assist the person in doing physical counter pressure manoeuvres by describing or demonstrating the techniques.
4. If no improvement occurs within 1 to 2 minutes, or if symptoms worsen or reoccur, EMS should be activated.
5. If the patient loses consciousness (syncope), follow the General treatment for an unresponsive patient.

Physical counter pressure manoeuvres

Physical counter pressure manoeuvres are used as specific interventions for presyncope of vasovagal or orthostatic origin.These manoeuvres include the contraction of muscles of the body such as the legs, arms, abdomen, or neck, with the goal of elevating blood pressure and alleviating symptoms. If there are no extenuating circumstances, lower-body counter pressure manoeuvres are favoured over upper-body and abdominal counter pressure manoeuvres, however, multiple methods can be beneficial, depending on the situation.

Unresponsiveness and altered mental states

A lowered level of consciousness is the abnormal state of inappropriate response or complete lack of response to sensory stimuli. A person can become unconscious suddenly (e.g., due to a stroke, electrocution or head injury) or gradually (e.g., in certain poisonings, or progressive hyperglycemia). An altered mental status may precede unconsciousness and the patroller may intervene before loss of consciousness occurs. An altered mental state may be a forerunner of unconsciousness, but the person may also experience normal responsiveness or even hyperactivity following an altered mental state.

Causes of unresponsiveness may include:

- altitude sickness
- angina
- asphyxia
- asthma
- diabetes
- electrocution
- epilepsy
- head injury
- heart attack
- hyperventilation
- lightning strikes
- poisoning

- stroke
- syncope

The level of responsiveness can be determined with the AVPU scale (Alert, Verbal, Pain, Unresponsive) describing what kind of stimulus the patient reacts to, if any (see Level of consciousness in Chapter 4)

General treatment for an unresponsive patient

If a person is found motionless, usually lying on the ground and/or in an unusual position, unconsciousness should be assumed and checked immediately. If a cervical spine injury is suspected, apply and maintain spinal motion restriction before turning the patient face up or moving them. Move the patient only as needed to open the airway or to reach a safe location.

1. Shout and shake the person gently.
2. Open the patient's airway.
3. Check for normal breathing for no longer than 10 seconds.
4. If the patient does not breathe normally start chest compressions, see CPR in chapter 6.
5. If the patient reacts only to pain or is unresponsive the airway should be kept open:

1. using the jaw thrust method if cervical spinal injury is suspected;
2. using the head tilt-chin lift method if cervical spine injury can be ruled out.

6. If cervical spine injury can be ruled out, move the patient to the semi-prone recovery position.
7. Establish the reason for unresponsiveness.
8. Check forMedicAlert identification.
9. Activate EMS and arrange for transportation to medical aid as soon as possible.
10. Administer oxygen, if available.
11. Continue to monitor and record the patient's vital signs, including the level of consciousness.

The rule is to give nothing by mouth (solids or liquids) if the patient is unresponsive.

Conclusion

The success of efforts to assist patients with medical conditions depends largely upon a systematic application of certain learned skills. Thoughts, decisions and actions in a situation could mean the difference between life and death.

17. Environmental injuries

Learning outcome:

Recognize, understand, and explain the treatment and avoidance of environmental injuries.

Upon completion of this chapter you should be able to:

1. Recognize the signs, symptoms and explain the treatment for the environmental injuries found in this chapter:
2. Demonstrate the treatment for the conditions found in this chapter
3. Explain how to avoid and prevent environmental injuries.
4. Recognize that the Workplace Hazardous Materials Information System (WHMIS) is a national system to provide information on hazardous materials used in the workplace.
5. Recognize that all controlled products fall into WHMIS classes as noted on a Safety Data Sheet (SDS).

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Altitude illness

Altitude illness can be categorized into three groups:

- Acute mountain sickness (AMS)
- High altitude pulmonary edema (HAPE)
- High altitude cerebral edema (HACE)

Ascending to higher altitude more gradually can reduce the risk of altitude illness.

A patient may have prescribed medication for altitude illness with them. Where permitted by local provincial or territorial laws, regulations and protocols, you may assist the patient in taking it based on the label instructions.

Acute mountain sickness

Acute mountain sickness due to hypoxia can show up at elevations as low as 2,100 to 2,400 metres (approximately 7,000 to 8,000 feet), or occasionally even lower. The signs and symptoms will vary according to the:

- physical condition of the patient
- patient's acclimatization to higher elevations
- rapidity of the ascent
- length of time spent at higher elevations

Acute mountain sickness

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Signs and symptoms	Treatment
• mild headache • mild insomnia • loss of appetite • shortness of breath when exercising	1. The symptoms should disappear within 24 hours. If they do not, have the patient descend to a lower altitude until the symptoms disappear. 2. Keep the patient from getting cold or overheated. 3. Adequate hydration should be maintained (but not forced) as symptoms of dehydration can mimic those of AMS. 4. If the symptoms persist or get worse, give oxygen and refer the patient to medical care.

High altitude pulmonary edema (HAPE)

A continued shortage of oxygen (hypoxia) causes a narrowing of the arteries of the lungs. In turn, this increases the pressure in the narrowed arteries. The increased pressure results in damage to the lung capillary walls and alveoli, which in turn causes an accumulation of fluid (pulmonary edema) and a reduction in oxygen uptake of the blood. It can quickly develop into a life-threatening condition. Pulmonary edema (HAPE) is about 10 times as frequent as cerebral edema (HACE), which is discussed below.

High altitude pulmonary edema (HAPE)

Signs and symptoms	Treatment
• marked breathlessness on exertion and at rest • headache • cough • Signs of advanced pulmonary edema include: • severe respiratory distress, cyanosis, audible gurgling sounds in the chest • severe cough with abundant sputum • rapid pulse	1. Take the patient to as low an altitude as possible. 2. Give oxygen, if available, during the descent and while in transit. 3. Try to keep the patient at rest. 4. Keep the patient from getting cold or overheated.
If there is evidence of a pulmonary edema, it is a medical emergency. Treat as a Load and Go.	

High altitude cerebral edema (HACE)

Cerebral edema leads to swelling of the brain with resultant increased intracranial pressure. Cerebral edema generally develops slowly, over a few days. It will probably not develop if a patient is exposed to high altitude for a two or three day period, such as a weekend.

High altitude cerebral edema (HACE)

Signs and symptoms	Treatment
• severe headache • insomnia • nausea and vomiting • ataxia (loss of coordination) • lassitude (weariness and weakness) • irrational behaviour	1. Take the patient to as low an altitude as possible immediately. 2. Give oxygen, if available, during the descent and while in transit. 3. Try to keep the patient at rest. 4. Keep the patient from getting cold or overheated.
If there is evidence of a cerebral edema, it is a medical emergency. Treat as a Load and Go.	

Heat and cold injuries

The systems of the body function less effectively as the internal body temperature falls below its normal temperature of 37°C. The body may also be severely damaged if the internal temperature rises above normal.

Body temperature

The temperature-regulating mechanisms of the body continuously attempt to maintain a balance between internal heat production (metabolism) and external heat gains or losses.

Heat injuries may be systemic such as heat stroke, or localized such as burns. Cold injuries may also be systemic, such as hypothermia, which affects the body as a whole, or localized such as frostbite, which affects only a part of the body.

Heat transfer mechanisms

Basic heat transfer mechanisms are identical whether applied to cold or heat injuries. Heat flows from a warmer object or environment to a cooler object or environment. This means that, in a cold environment, heat will be lost by the body to the outside; and conversely, in a hot environment, heat will be gained by the body from the outside.

Heat transfer occurs as a result of:

- radiation
- conduction
- convection
- evaporation
- respiration

Radiation

Radiation is the transfer of heat - without physical contact - from a warm object to a cooler one. Radiation of heat, especially from the head, is the most serious type of body heat loss. At temperatures below 5°C, there can be significant heat loss from an uncovered head.

Conduction

Conduction is the transfer of heat by contact from a warmer object to a cooler one (e.g. from the skier's body to a chair on the lift in cold weather, or a hot water bottle warming a cold body area).

Convection

Convection is the transfer of heat between an object and its fluid environment through the surrounding layer of air or water. For example, in cold weather and as the layer of air closest to the skin is warmed by the body, it rises away from the body by convection and it is replaced by cooler air or water. In the case of air, wearing clothing with closures at the neck and waist reduces this flow (e.g. turtlenecks, zip-together ski suits).

Evaporation

Evaporation of water requires heat. Evaporation of moisture on the skin draws heat from the body, thereby cooling it. Evaporation is most pronounced in a dry, hot environment, but is also significant in a dry, cold environment.

Respiration

Respiration heat loss is a combination of convection and evaporation, as inhaled cold dry air is warmed by the body to 37°C and humidified. Heat and moisture are lost on exhalation. Increased respiration during exercise and at higher altitudes increases the rate of heat loss and contributes to dehydration.

Other factors affecting body heat balance

Additional factors can affect the basic heat transfer mechanisms discussed above. They include: wind, water, clothing, and nutrition.

Wind

Wind vastly increases the amount of heat loss from the body due to convection. It removes the insulating layer of warm air surrounding the body; even light winds can change mild temperatures into uncomfortably cold conditions.

Wind chill temperature

The wind chill temperature is the theoretical temperature which would result in the same heat transfer rate as the combination of actual temperature and wind speed. In simple terms: it's how cold the wind makes the air feel.

Water

Water conducts heat away from the body 32 times faster than air of the same temperature. If the water is moving or the patient is swimming, heat loss is further increased as a result of convection. Any time moisture comes in contact with the body (e.g. rain, immersion in water, perspiration-dampened clothing, etc.), the body loses heat at a rapid rate.

Clothing

Clothing traps a thin layer of air next to the body. The air is prevented from escaping by closures at the neck, waist, wrist. Windproof clothing prevents removal of this insulating layer of air by keeping the underlying layers of clothing dry for maximum insulating value. Multiple layers of clothing are better than a single thick layer, because they trap more layers of air. To avoid overheating, individual layers can be removed without causing excessive cooling.

Food and nutrition

Diet greatly affects the internal production of body heat (metabolism). Food fuels the metabolism. The process of digestion also creates heat. If exposed to cold temperatures, meals should be regular, and frequent snacks should be eaten. Alcohol should be avoided - it dilates peripheral vessels, thus increasing heat loss through the skin, and reduces blood sugar levels. Similarly, smoking should be avoided because it constricts the peripheral vessels, thus pre-disposing the extremities to cooling and frostbite.

Cold Exposure Injuries

Hypothermia

Hypothermia is a serious cold injury which occurs when the body loses more heat than it can produce or retain. The nervous, cardiovascular, respiratory and digestive systems function less efficiently as the core body temperature falls below the normal 37°C. Should the core temperature continue to fall, these functions may cease and death may follow.

Core body temperature refers to that part of the body comprising the brain, heart, lungs, and abdominal organs. There is no good way of measuring core body temperature in the field; the mouth, ear, and armpit temperatures are not accurate because they measure surface temperatures. However, reference to the table stages of hypothermia will allow a good estimate of the patient's condition.

Hypothermia does not necessarily occur only in winter. It can occur at any time of the year as a result of inadequate heating, clothing, or nutrition. Hypothermia can be classified into two general categories according to the rate of heat loss, acute and chronic.

Acute hypothermia

Acute hypothermia may develop over a short period of time as a result of immersion in cold water, or over a period of up to 12 to 24 hours exposure to cool or cold weather conditions.

Cooling rates vary widely in patients exposed to cold weather according to the amount and type of clothing worn, the level of exercise (heat production) maintained, the state of nourishment, and body size. In severe exposure, if the condition is left untreated, death may occur within hours of the onset of the first symptoms of hypothermia.

In the case of cold water immersion, the average patient may remain conscious for up to 1.5 hours in water at 0°C. Sudden death on immersion in cold water is not a result of hypothermia, but of drowning or cardiovascular problems. Cardiovascular problems occur because, in the case of water immersion, the muscles of the larynx will spasm violently to seal off the airway and protect it from further aspiration. This protects the lungs, but will lead to asphyxiation due to lack of oxygen and ultimately cardiac arrest.

Chronic hypothermia

Chronic hypothermia develops over a period of time. This is seen most commonly in the elderly as a result of aging processes, certain diseases, medications taken and inadequate heating in their homes.

As people age, their body circulation system may lose its ability to constrict blood vessels in the skin and extremities in order to reduce heat loss and may also lose the ability to shiver to increase heat production. Subtle changes in behaviour may be the only signs present.

Prevention of hypothermia

Incidents happening on the ski hill or trail can result in the patient suffering from hypothermia, if their body is cooling rapidly and not handled properly.

The following are a few points to remember:

- Place insulating material between the patient and the snow to reduce conductive heat loss while waiting for a toboggan and administering treatment.
- If clothing has been removed or undone during the examination, replace it to prevent further heat loss (e.g. replace hats, close jackets).
- Put a layer of warm clothing on top of the patient. If it is very windy or cold, provide some shelter and warmth by huddling.

- Remove the patient from the hill or trail as soon as possible.

Hypothermia signs and symptoms

Characteristic	Mild	Moderate	Severe	Critical
Core temperature	35-34°C	33-32°C	31-29°C	< 29°C
Skin	Cold and pale	Cold and possibly waxy	Cold and waxy	Cold and bluish-grey
Muscle tone and function	Intense, uncontrolled shivering; movements become less coordinated	Shivering slows, muscles become clearly rigid but able to maintain posture	Shivering stopped, muscle rigidity continues	Very rigid, no voluntary motion
General	Fatigue, weakness, pain and discomfort	Fatigue, weakness	Marked weakness and lack of coordination, looks exhausted, clumsy (appears drunk)	Coma, appears dead
Respiration	Increased rate	Slower rate, shallow	Slow rate, shallow	Little or no apparent breathing
Pulse	Increased rate	Decreased rate	Slow	Slow and erratic, at risk of ventricular fibrillation
Pupils	Respond to light	Respond to light	Nonreactive	May be dilated
LOC	Alert and able to help oneself	Alert but drowsy, may appear in contact with surroundings or may behave strangely	Initially alert but irrational. Denies problem and may resist help. Gradual loss of consciousness	Unresponsive, no response to pain
Speech and thought	Signs of difficulty speaking, sluggish thought, amnesia apparent	Slow, vague, slurred speech, mental confusion, apathy, total amnesia may be apparent	Slurred speech (appears drunk) total amnesia maybe apparent	None

Reaction of the body to cold

Initially, the extremities become very cold while the body attempts to maintain a normal core temperature. Once the core temperature begins to fall as heat loss exceeds heat production, the signs and symptoms listed below start to appear.

Early signs of heat loss

The body's initial response to exposure to cold is to prevent further heat loss. To prevent further heat loss, the body constricts blood vessels in the skin and extremities. This is called vasoconstriction. Vasoconstriction reduces the flow of warm blood from the core to the skin and extremities, and of the cool blood returning to the core. As a result, the temperature of the extremities falls. Cold hands and feet, numbness and ultimately loss of sensation to touch or pain ensues.

The body's other response to cold exposure is to increase heat production by shivering. Shivering is a surface muscle activity which generates warmth. However, shivering uses energy, and if the exposure to cold continues, it will contribute to further deterioration of the patient.

Continued response to heat loss

The muscles below the skin weaken and peripheral nerve function becomes impaired. This leads to loss of co-ordinated movement, especially in the extremities. The loss of heat from the body core is delayed because the cool shell of skin and surface muscles acts as an insulating layer for deeper tissues. As the exposure to cold continues, the body will sacrifice the limbs first, then deeper and deeper tissues, in an effort to maintain the temperature of the vital organs (the body core).

Once the core starts to cool, the activity of the brain, heart and lungs is impaired. If their temperature reaches a critical point, they will cease to function and death will result.

Impairment of brain activity has serious consequences, as judgment may be affected. The patient may not recognize the seriousness of the situation and therefore treat his or her own hypothermia improperly.

Final response to heat loss

When the temperature drops below a critical point, the core temperature falls rapidly. If this occurs, a patient is incapable of producing heat to re-warm the body. Heat must be supplied to the body, but this should normally be done only in a hospital setting.

General treatment of hypothermia

The best treatment of hypothermia is prevention through good preparation. This means proper clothing, preferably layered, so the amount of insulation can be adjusted. It also means avoiding windy or humid conditions and not allowing the body to perspire freely. If you find a patient who is suffering from hypothermia, or find yourself in the process of becoming such a patient, take steps to reduce heat loss immediately. The longer the body core loses heat, the more difficult it is to re-warm.

1. Ensure that the patient's airway, breathing and circulation are adequate. After the primary assessment, begin specific treatment.
2. Prevent further heat loss. Place the patient out of the wind - or remove from the water - in the best shelter available. Replace wet clothing with dry clothing, or cover with blankets or sleeping bags.
3. Place as much insulation as possible between the patient and the ground. Make sure the patient's head and neck are covered.

4. For patients with mild to severe hypothermia, add heat to re-warm the patient's body. Build a fire, use a camp stove to warm the air around the patient, use external warmth such as heat packs or hot water bottles applied to the head, neck, chest, and groin areas.
5. If more sources of warmth are available, place them along the sides of the trunk. The hot water bottles and heat packs should not be put directly on the skin to avoid burns. Leave on an undershirt or insert a towel to prevent tissue damage.
6. If the patient is fully conscious, give fuel in the form of hot, sweet drinks (tea, soup, warm sweetened juice) and sweetened foods (chocolate, candy, dextrose tablets). Sugar is the food most quickly transformed into heat and energy. Do not administer alcohol because it dilates the superficial blood vessels and further reduces the core temperature.
7. Handle the patient gently to avoid mechanically forcing the cold blood which has pooled in the extremities back to the heart, a condition known as “after drop”. Such action will further reduce the core temperature, and can precipitate fibrillation, a condition in which the heart muscle contracts rapidly without resulting in adequate pumping action.
8. If the patient in unresponsive, place the patient in a semi-prone position. Monitor to ensure an open airway is available, prevent further heat loss, and transport to medical aid as soon as possible. An unresponsive patient should be considered a Load and Go.

Treatment for hypothermia

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Summary of treatment of mild to severe hypothermia

Ensure adequate ABCs

Prevent further heat loss:

- Remove from wind or water
- Remove wet clothing replace with dry clothing
- Cover with blankets or sleeping bags
- Ensure head and neck covered
- Place insulation between patient and ground

Add heat to rewarm body:

- Use fire or stove to warm air around the patient.
- Apply heat packs or hot water bottles to head, neck, chest, groin (along body if available), however, avoid contact between heat sources and skin.

Provide food and fluids (if alert):

- Give warm tea, coffee, soup or warm sweet juice.
- Give chocolate, candy, sugar or dextrose tablets (sugar is most rapidly turned into energy).
- Do not give alcoholic beverages (vasodilation leads to cooling).

Keep patients awake (ignore pleas to leave alone)

Advise patients with any signs of moderate hypothermia to seek medical aid (or organize transport to medical aid)

Summary of treatment of unresponsive patients with severe or critical hypothermia

- Patient is in serious trouble. Maintain continuous watch.
- Handle gently.
- Ensure the airway is open.
- Transport to medical aid without delay (unresponsive = LOAD & GO).
- If possible, get the patient to medical attention within 1-2 hours. Rush there rather than attempting rewarming.
- The temperature in the vehicle should be no warmer than 18-22°C.
- Stabilize the temperature only. Rewarming may be fatal. Exhale warm air near mouth/nose.
- Rough handling can cause cardiac arrest. Avoid forcing blood pooled in extremities back to heart, which reduces the core temperature and can provoke ventricular fibrillation.
- Introduce warm steam, if possible (using a kettle, for example).

For patients with signs of critical hypothermia:

- Don’t give up, assume the patient can be revived
- Keep the temperature even with external heat sources, do not rewarm
- Monitor vitals closely
- Do not give CPR or do rescue breathing for a slow pulse or low respiratory rate
- If there is no breathing or pulse for TWO FULL MINUTES begin CPR and rescue breathing.
- Medical aid is imperative

Warnings

- Treatment for severe and critical hypothermia is to stabilize the temperature only. Rapid re-warming may be fatal. Rough handling may cause cardiac arrest.
- A number of experts suggest that if there is a good possibility of getting a patient to medical attention within one or even two hours, the patient should be rushed there without receiving re-warming treatment.
- A severe or critical hypothermic patient, who has been kept alive by artificial respiration and CPR, is more likely to recover given the re-warming techniques available at the hospital.
- The low body temperature will keep demand for oxygen - by the brain and other organs - to a minimum until the patient receives treatment.
- If it is clearly impossible to get the patient to medical help within a reasonable time frame, start re-warming in the field after the resuscitation treatment.
- In hypothermia, the carotid pulse may not be easily detected. It may be weak and slow, with a rate of 20 or even lower. Therefore the pulse should be checked every one to two minutes. You will have to estimate temperature. The easiest and most accurate temperature estimate in the field is found by using the signs in the hypothermia signs and symptoms table above. This will help you to decide whether the hypothermia is mild, moderate, severe or critical.

Transporting hypothermic patients

The transport medium used in mild and moderate hypothermia should be as warm as possible.

In severe and critical hypothermia, the temperature in the vehicle should be between 18°C and 22°C with as smooth of a ride as practically possible. If ventilation must be assisted, use mouth-to-mask, as opposed to bag-to-mask, to maximize core temperature increase.

Re-warming and after-drop

After-drop is the phenomenon where the body temperature continues to fall even though active re-warming is in progress.

After-drop, also called re-warming shock, happens when the outside areas of the body and the extremities are warmed before the core. What happens is that the blood vessels near the surface start dilating. The blood from the core flows into these peripheral vessels. The heart is still too cold to cope with the increased circulation demands, and the body core including the heart becomes even colder as the cold blood from the peripheral vessels is returned to the core. This can lead to cardiac arrest.

Localized cold injuries

These include:

- non-freezing cold injury
- superficial frostbite
- deep frostbite

Non-freezing cold injury and localized hypothermia

Under conditions of prolonged cooling of a body part, the blood becomes thicker and capillary circulation comes to a halt, even though the tissue is above the freezing point. If the part is not re-warmed promptly, the flow of blood to adjacent tissue is reduced and the chilling spreads. This condition can occur with prolonged exposure to above-freezing temperatures. It is often experienced by survivors of an aircraft crash or shipwreck or by patients injured or marooned in an unheated ski cabin.

A non-freezing cold injury requires several hours to a day or two to develop at above-freezing temperatures. Damage from this condition is called localized hypothermia, also known as frost-nip, immersion foot or trench foot. It occurs because of decreased blood flow and the resulting lack of oxygen and nourishment to the tissues at above freezing temperatures. Immersion or trench foot occurs from prolonged exposure to cold water. It is quite common among hikers and hunters.

Non-freezing cold injury and localized hypothermia

Signs and symptoms	Treatment
• skin of the part in question is cold to the touch and pale, but not frozen • feeling is usually still present to some extent • there will be tingling, pain and redness during the re-warming	1. Remove the patient from the exposure. 2. Remove wet clothing. 3. Re-warm the part. This can be done by contact with a warm body part such as a hand or armpit, or immersion in warm water.

Frostbite and superficial frostbite

Frostbite

Frostbite is the freezing of body tissue which occurs when the body-warming processes no longer function. Frostbite is usually restricted to the extremities, or to areas like the ears, nose, chin, toes and cheeks. The severity of the injury depends on the intensity of the initial exposure and the length of time before adequate circulation returns. Tissue damage in superficial frostbite is minor and the response to treatment is good.

If the tissue temperature falls below freezing, the tissue starts to freeze and crystals form. As the crystals form, water is drawn from the tissue. This dehydrates the cells, increases the concentration of salts within them and finally causes their destruction. Continued exposure to the cold will result in deeper freezing until blood vessels, nerves and even the bones are frozen. This process may be accelerated if the patient is in a state of panic or shock from another injury.

Frostbite and burns are similar in the kind of damage they result in and in their treatment. Both frostbite and burns destroy the skin and/or tissue. The difference is one of cause - the general treatments are similar. Frostbite frequently results in a long term reduction of the patient's tolerance to cold by the injured part.

Superficial frostbite

Superficial frostbite may include true tissue freezing. It occurs when there is sufficient heat loss in the local area to allow ice crystals to form and extract cellular water. The skin surface is hard, but the tissue underneath is soft. Superficial frostbite involves only the skin and the tissues directly under the skin. It frequently occurs on the tip of the nose, earlobes, cheeks, toes and fingers.

During re-warming, expect the patient to complain of a tingling or a burning sensation. The injured part may become numb and then swell and may become warm, and tender or painful.

The damaged area can be treated immediately by using body heat, such as covering the frost-bitten area with a warm hand or having the patient place injured fingers in their armpits. Frost-

nipped toes can be treated by placing them on the abdomen of a friend under the clothing. Be prepared for some swelling of the injured part.

After re-warming, the injured part may become numb, then swell and become warm, tender and sting. This may stop the patient from being able to walk.

Evidence of discolouration or blister formation indicates more than superficial freezing.

Transport the patient to medical aid. Note that this phase may not become apparent for several days.

Frostbite and superficial frostbite

Signs and symptoms	Treatment
• usually has a slow onset with the patient unaware until they experience a loss of sensation • skin initially reddens and then blanches and becomes white • skin will become firm, white and waxy in appearance as the freezing progresses • tissue underneath is soft and resilient • complaint of a tingling sensation or sharp pain in the area • sometimes there will be no pain at all, if the nerves have been frozen; or the pain may stop suddenly as the nerves are frozen	1. Warm the affected area. 2. Keep the patient rested and elevate the affected area if swelling and loss of function occur. 3. Protect the injured area with dressings. 4. If problems persist, transport to medical aid.

Deep frostbite

Deep frostbite occurs when tissue freezes down into, and beyond, the subcutaneous layers. Irreversible damage occurs if the condition is not arrested. Any evidence of discolouration or blister formation indicates that more than a superficial freezing injury has occurred. However, this phase of injury may not be apparent for several days.

Re-warming is best undertaken where medical help is available for both pain relief and dressings.

Re-warming deep frostbite

If, after careful consideration of the above, you attempt re-warming, use the following rapid re-warming method:

1. Re-warming should be achieved by immersing the affected part in water between 37°C (body temperature) and 40°C (98.6°F and 104°F) for 20-30 minutes. For severe frost-bite, re-warming should be accomplished within 24 hours. Chemical warmers should not be placed directly on frostbitten tissue, because they can reach temperatures that can cause burn and exceed the targeted temperatures.
2. Continue re-warming until the blood has circulated completely to the end of the extremity and the skin is pink throughout. This may take longer than 30 minutes, depending on the severity of the injury.
3. Protect the injury with dressings.
4. Immobilize and transport to a medical aid facility.

5. Be prepared for the injured to experience extreme pain.

Deep frostbite

Signs and symptoms	Treatment
• injured person cannot feel the frozen area • skin surface is white, hard and the tissue underneath is hard	1. Due to the seriousness of the injury, the most effective treatment is to send the patient to a medical aid facility. 2. If transportation to medical aid is not possible, transport the patient to a place where proper re-warming can be applied and maintained (e.g. a farm house, chalet, or base camp). 3. Leave the affected area frozen if there is no guarantee of preventing re-freezing after thawing has occurred. 4. An individual can walk or ski a long way on frozen feet without further injury. If a frozen foot or toe is re-warmed on the trail, the patient immediately becomes a stretcher case. They cannot assist in their own rescue and may create a major crisis not only for themselves but for their companions. Do not permit anyone to walk on thawed feet or toes. Very serious loss of tissue is almost certain to result.

Common hazards treating frostbite

Frostbite is serious. Much of its treatment involves avoiding certain actions as described below:

- Do not rub the affected part with snow. This will not get the skin above a freezing temperature, and may cause skin damage.
- Do not rub the affected part at all as the skin may be brittle and rubbing may cause further damage.
- Do not blow into a glove to warm cold fingers. Your breath will put moist air into the glove, which eventually condenses making the fingers colder.
- Do not allow the patient with severe frostbite to smoke. Smoking constricts the blood vessels, reducing circulation and, therefore, warming.

Do not use hot baths or any heating method which will cause vasodilation. (see "Re-warming and after-drop")

Heat exposure injuries

The body constantly produces heat. If this heat cannot be dissipated from the body or if external heat is added, the core temperature may rise above normal. A rise in body temperature results in severe damage to the central nervous system and the kidneys.

The body dissipates heat by conduction, convection, radiation and evaporation.

When the atmospheric temperature is relatively high, most of the heat is given off by evaporation. The body perspires rapidly, losing water and chemicals such as potassium and sodium. These chemicals are necessary for conduction of nerve impulses, and if they are not replaced, the body cannot function properly.

If the surrounding air is also humid, little evaporation occurs, heat cannot be dissipated rapidly enough and there is danger of excessively high body temperature.

Heat exposure injuries, in order of increasing severity are:

- heat cramps
- heat syncope
- heat exhaustion
- heat stroke

Prevention

Heat exposure injuries are the result of the inability of the body to cool itself or of a profound and rapid loss of water and chemicals. Heat exposure injuries are relatively easy to prevent. Consider the following:

1. Gradually acclimatize to working in warm or hot environments.
2. Wear light-coloured garments made of materials that allow the easy passage of moisture to facilitate evaporation (fabrics that breathe).
3. Increase fluid intake.
4. Schedule peak physical work periods to cooler periods of the day.

Heat cramps

Heat cramps are painful involuntary muscle spasms that usually occur during heavy exercise in hot environments. The spasms may be more intense and more prolonged than are typical night time leg cramps. Inadequate fluid intake often contributes to heat cramps.

Muscles most often affected include those in the calves, arms, abdominal wall and back, although heat cramps may involve any muscle group involved in exercise.

To replace salts lost in sweating, the patient should drink at least a litre of fluid containing salt. This can be an electrolyte-carbohydrate mixture that can include juice, or a commercial electrolyte-carbohydrate drink such as Gatorade, or fruit juices / water with added salt. The rule of thumb is to use one teaspoon of salt per litre of water.

Heat cramps

CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI

Signs and symptoms	Treatment
Onset is acute with: • pain as the muscle forcefully contracts • visible bulge in the muscle underneath the skin where the muscle is located • inability to flex and move the muscle normally • thirst	1. Have patient stop any strenuous activity, and move into the shade. 2. Practice gentle, range of motion stretching and gentle massage of the affected muscle group. 3. Encourage fluid intake by mouth. 4. Apply moist towels to cramping muscles. 5. If symptoms are not relieved, transport to medical aid.

Heat syncope (fainting)

Heat syncope is a fainting episode caused by decreased blood volume reaching the brain.

The dissipation of heat is a priority during work in a hot environment. When not acclimatized, there is an increased movement of blood to the skin and to the working muscles. This may result in a temporary insufficiency of blood flow to the brain.

A temporary loss of consciousness may ensue.

Heat syncope

CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI

Signs and symptoms	Treatment
• dizziness followed by fainting	1. Lay the patient down if they feel dizzy. 2. Loosen tight clothing. 3. Move the patient to a cooler environment. 4. Keep the patient lying down with the legs elevated to a maximum of 30 cm. The condition should be self-resolving and no further treatment should be necessary.

Fainting is usually followed by a fall. The resulting horizontal position of the body improves the blood flow to the brain and allows spontaneous recovery.

Heat exhaustion

The mechanism of heat exhaustion is the same as for heat syncope. The patient, however, may not experience a loss of consciousness. Because heat exhaustion is usually accompanied by fluid loss, there may be signs and symptoms of mild hypovolemic shock.

Heat exhaustion

Signs and symptoms	Treatment
• pale, cool, clammy skin • body temperature is usually normal but may be low • weak, rapid pulse • rapid, shallow respiration • headache • nausea • profuse sweating	1. Stop all physical activity and move the patient to a cooler environment to rest. 2. Remove any excess clothing. 3. If conscious, give the patient water to drink. Sports drinks or water with sugar or salt may also be helpful. 4. If available, administer oxygen. 5. Reassure the patient and monitor their breathing and temperature. 6. If you do not notice signs of recovery after a short rest, arrange to transport the patient to a medical aid facility. Other medical conditions may be at play.
The greatest danger of heat exhaustion is that it may rapidly progress to heat stroke, which can be life-threatening.	

Heat stroke

This is the most life-threatening of the heat exposure injuries. Heat stroke is fatal if not treated immediately, and has a fairly high mortality rate even when treated.

Heat stroke is the result of the collapse of the body's cooling system. Without any effective mechanism for heat dissipation, the body's temperature rises. The delicate structures of the central nervous system are usually affected. Death may rapidly ensue if conditions are not corrected.

Heat stroke

Signs and symptoms	Treatment
• rapid onset of the condition • hot, dry, flushed skin • full, rapid pulse initially. May become irregular or decrease progressively • deep respirations initially, becoming progressively more shallow • muscle twitching or convulsions • dilated pupils • very high body temperature (above 40 C) • progressive decrease in the level of consciousness, leading to unresponsiveness and death	1. Depending on availability of water and materials: 2. Activate EMS without delay. 3. Stop all physical activity and move the patient to a cooler environment to rest. 4. Remove as much clothing as possible. 5. Cool the patient down rapidly. A cold shower, or immersion in cold water, is ideal. 6. If this is not available, wet the patient with cool water and place cold packs under the arms, on the neck, groin and behind each knee. 7. Administer high flow oxygen. 8. If conscious, give the patient water to drink. Sports drinks or water with sugar or salt may also be helpful. 9. Monitor the patient's breathing and temperature. Try to reduce the temperature to 38 C. Watch for evidence of hypothermia from too much cooling!

Exposure to hazardous materials

Workplace Hazardous Materials Information System 2015 (WHMIS)

The Workplace Hazardous Materials Information System (WHMIS) is a comprehensive plan for providing information on the safe use of hazardous materials used in Canadian workplaces. The WHMIS was originally created in 1988 with representatives from government, industry and labour unions to ensure that Canadian workers are aware of the safety and health hazards that may be associated with the materials or chemicals they use every day at work. This is a right entitled to employees under law (see Canada Labour Code and the Canadian Occupational Safety and Health Regulations (Part X).

Exposure to certain hazardous materials can contribute to, and even cause, many serious health issues such as: organ (kidney, lung, or liver) damage, sterility, cancer, burns, central nervous system damage, and rashes. Some materials are safety hazards on their own and can cause fires or explosions. WHMIS was implemented to reduce injuries, illnesses, deaths, medical costs, and fires caused by hazardous materials.

A modified WHMIS, referred to as WHMIS 2015, now incorporates the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). This includes new criteria for hazard classifications and requirement for labels and Safety Data Sheets (SDS). WHMIS 2015 will be implemented over a multi-year transition period to allow for adjustment to the new system.

Implementation and responsibilities

WHMIS 2015 is enforced by the Labour Branch of Human Resources Development Canada for federal workplaces, and by the provincial or territorial agencies responsible for occupational health and safety for most other workplaces. The following link provides a list of the appropriate provincial authorities by province as not all provinces have identical agencies.

whmis.org

WHMIS 2015 is managed through the implementation of four specific processes:

1. Hazard identification and product classification.
2. Use of specific product labels.
3. Creation of SDSs.
4. Education programs for employees and employers.

Employers are required to establish education and training programs for workers exposed to hazardous products in the workplace. Employers must also make sure that the products are labelled appropriately including workplace labels as needed, SDSs are present and available to workers for each product, and ensure appropriate control measures are in place.

Workers are required to participate in the training programs available to them and are additionally responsible for the use of that information to help them work safely with hazardous materials. They should become familiar with any hazardous materials in their workplace, obey all of the prescribed precautions and warning labels. They are also responsible for informing their employers when labels on containers have been accidentally removed or if the label is no longer readable.

Safety Data Sheets (SDSs)

A safety data sheet is prepared by the supplier or manufacturer of the hazardous material. It is a document that contains information on the potential hazards (health, fire, reactivity and

environmental), use, storage, handling and all emergency procedures related to the material. In other words, this sheet provides all of the information required to work safely with the controlled products as regulated by WHMIS 2015 legislation. All controlled products fall into one or more of nine WHMIS 2015 classes as noted in the chart below.

WHMIS 2015	Types of hazards
	Gas cylinder (for gases under pressure)
	Flame (for fire hazards)
	Flame over circle (for oxidizing hazards)
	Skull and Crossbones (can cause death or toxicity with short exposure to small amounts)
	Health hazard (may cause or suspected of causing serious health effects)
	Exclamation mark (may cause less serious health effects or damage to the ozone layer*)
	Corrosion (for corrosive damage to metals, as well as skin, eyes)
	Exploding bomb (for explosion or reactivity hazards)
	Environment* (may cause damage to the aquatic environment)
	Biohazardous infectious materials (for organisms or toxins that can cause diseases in people or animals)

* The GHS system also defines an environmental hazards group. This group (and its classes) was not adopted in WHMIS 2015. However, you may see the environmental classes listed on labels and SDSs. Including information about environmental hazards is allowed by WHMIS 2015.

Information on SDS

There are eleven sections that must be present on an SDS in Canada, and four (sections 12 to 15) that are optional for information to be provided. They are as follows:

	SDS section	Information requirements (partial list)
1	Identification	Product identifier, recommended use and restrictions on use, supplier contact information, emergency phone number.
2	Hazard identification	Classification (hazard class and category), label elements (including hazard pictogram, signal word, hazard statement and precautionary statements) and other hazards (e.g. thermal hazards).
3	Composition/information on ingredients	For a hazardous product that is a substance: the chemical name, synonyms, Chemical Abstracts Service (CAS) number and the chemical name of impurities, stabilizing solvents and stabilizing additives where classified and that contribute to the classification of the product. For a hazardous product that is a mixture: for ingredients that present a health hazard, the chemical name, synonyms, CAS number and concentration. Note: Confidential Business Information Rules may apply.
4	First-aid measures	First-aid measures by route of exposure as well as most important symptoms/effects.
5	Fire-fighting measures	Suitable (and unsuitable) extinguishing media, specific hazards, special equipment and precautions for fire fighters.
6	Accidental release measures	Protective equipment, emergency procedures, methods and materials for containment and clean up.
7	Handling and storage	Precautions for safe handling, conditions for storage, including any incompatibilities.
8	Exposure controls/ personal protection	Exposure limits, engineering controls, personal protective equipment.
9	Physical and chemical properties	Appearance, odour, odour threshold, pH, melting/freezing point, boiling point and range, flash point, upper and lower flammable or explosive limits.
10	Stability and reactivity	Reactivity, chemical stability, possible hazardous reactions, conditions to avoid, incompatible materials, hazardous decomposition products.
11	Toxicological information	Description of various toxic effects by route of entry, including effects of acute or chronic exposure, carcinogenicity, reproductive effects, respiratory sensitization.
12	Ecological information*	Aquatic and terrestrial toxicity (if available), persistence and degradability, bioaccumulative potential, mobility in soil.
13	Disposal considerations*	Safe handling and methods of disposal, including contaminated packaging.
14	Transport information*	UN number and proper shipping name, hazard classes, packing group.
15	Regulatory information*	Safety, health and environmental regulations specific to the product.
16	Other information	Other information, including date of the latest revision of the SDS.

*Sections 12 to 15 require the headings to be present, but under Canadian regulations, the supplier has the option to not provide information in these sections.

Copies of all relative SDSs documents should be available at all locations where that particular hazardous material is being used, as well as in a location where first aid personnel will have ready access in any emergency.

A copy of the SDS should be sent with the patient to medical care to ensure appropriate care by medical professionals for all treatments involving chemical burns to the skin or eyes.

Burns

A burn is an injury to the skin, or deeper tissues of the body, caused by contact with heat, radiation or chemicals. The contact causing the burn may be in the form of:

- hot solids
- liquids
- steam, air or other gases
- sunlight or ultraviolet light
- electricity
- X-rays, radium
- chemicals such as strong acids or alkalis

Burns damage the skin or tissues and result in loss of body fluids. This can cause shock. Burns can also lead to infection; so blisters should be kept from breaking and the burns protected with sterile dressings.

Classifications of burns

When first examined, classification of burns may be difficult or even impossible. However, they can generally be classified according to the depth of tissue damage.

First-degree burns

A first-degree burn is a superficial skin burn that merely reddens the skin. This burn will have minor pain associated with it, and can be compared to a mild sunburn. It usually heals in two to five days, and leaves no scarring.

Figure 17-1: First degree burn.

Second-degree burns

Second-degree burns, or partial-thickness skin burns, involve both the epidermis and the dermis, and may blister the skin. These burns, which can resemble a sunburn with blistering,

Figure 17-2: Second degree burn.

will probably be the most painful type of burn because the nerve endings are damaged. They will take five to 21 days to heal, unless infection occurs resulting in a longer period of recovery.

Third-degree burns

Third-degree, or full-thickness burns, destroy the skin completely and may extend into the deeper tissues, sometimes even charring the muscle and bone. This type of burn may not be very painful because the nerve endings may also have been destroyed.

Figure 17-3: Third degree burn.

Estimating the size of the burn area

It may be difficult to determine the depth of a burn until long after it occurs, but you can estimate the area burned.

Any second-degree burn involving more than 10 per cent of the body area, around the mouth or the one per cent perineal area is serious. Any third-degree burn regardless of size is serious. These must be referred to a medical aid facility.

For small areas, it is possible to estimate the size of the burn by comparing it with the size of the patient's outstretched palm and fingers, which represents an area of about one per cent. For larger burn areas the rule of nines is useful.

An infant's head represents a larger portion of the body's surface area than an adult’s.

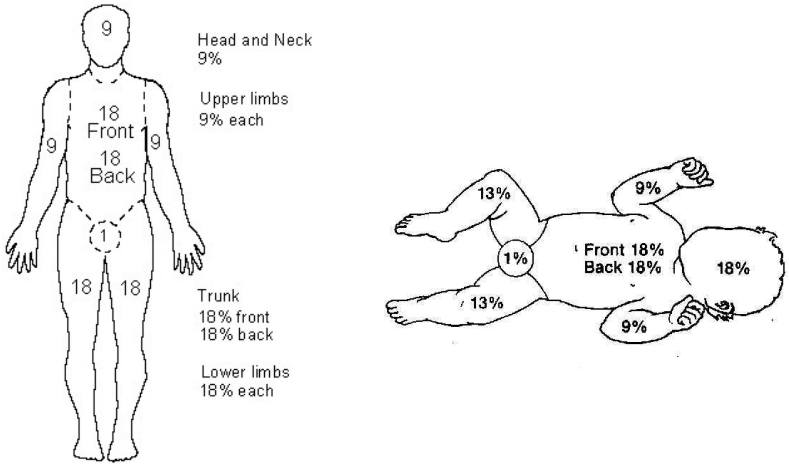

Figure 17-4, 5: Rule of nines - adult, infant.

Shock in burn injuries

Shock in burn injuries is due to a fall in the effective circulating blood volume caused by drainage of fluids from the burn. Drainage of a fluid similar to plasma into the area of a burn causes swelling and blistering. The greater the area of the burn, the greater the loss of fluid. The body can compensate for this loss up to a point, but as the volume of the loss increases, hypovolemic shock occurs.

General treatment for burns

1. Remove the cause. If the patient is on fire, douse the flames with non-flammable liquid (water or milk) or smother the flames with blankets, sheets, rugs, etc.
2. Initiate basic life support if necessary.
3. Cool the burn as soon as possible using clean running water for 10 minutes.
4. Clothing and jewelry in contact with or close by the burned skin should be removed to support cooling and reduce additional discomfort.
5. After the burn has been cooled, apply non-stick, sterile dressings to the burned area. If sterile dressings are not available, use a clean cloth or plastic film to protect the area during transit to further medical care. Dressings relieve pain by protecting the burn from the air. They also help in the prevention of infection.
6. Treat for shock.
7. If the burn area was large requiring much cooling water, watch for hypothermia.
8. Arrange for transport to a medical aid facility.

Immediate advanced medical aid is required if you encounter any of the following:

1. Burns to the face, inside the mouth, neck, hands, feet or genitals.
2. Any third-degree burns.
3. Second-degree burns that cover more than 10 per cent of the body.
4. Burns that occurred as a result of an explosion.
5. Second- or third-degree burns in children or the elderly.

Common hazards treating burns

Burns are serious. Much of its treatment involves avoiding certain actions as described below:

- Do not remove any charred clothing, metallic flakes or charred tissue from a burn. These materials have become imbedded (baked) into the skin and cannot be removed without causing more damage.
- Do not apply absorbent cotton, wool, or other fibrous material directly to a burn. Strands of fibrous material tend to stick to the fluid being lost from a burn and increase the chances of infection.
- Do not apply ointments to burned areas. Ointments form a barrier between the surfaces of the skin and the burn and tend to hold in the heat.
- Do not break blisters. Breaking the skin creates an open wound that allows body fluid to escape and increases the potential for infection.
- Do not apply ice or ice water to burn wounds.

Specific treatment for minor burns (small and first-degree burns)

1. Immerse in clean, cold water for two to five minutes.
2. If unable to immerse the burn, use cold wet applications to relieve pain and decrease the depth of burn by reducing heat.
3. Cover with a sterile dressing.

Early application of cold water is the best treatment.

Chemical burns

The severity of the damage depends on the properties of the chemical, its concentration, and the duration of the exposure. Most chemical injuries are caused by acids or alkalis.

Some of the more common acids are: sulphuric (battery acid), hydrochloric (also called muriatic), nitric acid and acetic acid. Acids cause early visible damage, but penetrate less deeply than alkalis. They are fairly easily washed out. If washed out immediately, there may be less serious damage.

Strong alkalis will penetrate rapidly into tissue. Liquid alkalis should be diluted immediately with water; solid alkalis should first be brushed off, then any remaining chemical immediately diluted with water. This is especially important with eye injuries due to alkalis, since the chemical will bind with and penetrate cells quickly and cause blindness.

Some of the more common alkalis are:

- household bleach
- caustic soda (sodium hydroxide)
- lye
- drain cleaners
- cleaning agents
- ammonia
- cement
- plaster

Treatment of chemical burns:

Identify the cause, and secure the scene. **Do not go if unsecured.**

1. Wash out strong acid or alkali burns immediately with large quantities of water (at least 20 minutes). If the corrosive agent is in a solid or powder form, brush off as much as possible before flushing the affected area.
2. Remove clothing soaked with the chemical and wash the skin with large amounts of water.
3. If the chemical is in the eye, flush thoroughly with large amounts of water. Make sure that the upper and lower lids are both washed out. Continue flushing for at least 20 minutes.
4. Give general first aid as for burns. (see "General treatment for burns")
5. Transport to medical aid.

Respiratory complications

The respiratory tract is susceptible to damage from the following heat-related sources:

- inhalation injuries
- thermal injuries
- smoke injuries

Inhalation injuries

Inhalation injuries include thermal (burns) and chemical (smoke or gas) sources. The severity is determined by the chemical nature of the substance, temperature, volume and toxicity of the substance.

Typically, inhalation injuries include airway damage or obstruction or lack of oxygen. The patroller must be vigilant and continually monitor the patient's condition. Inhalation injuries may compromise ABCs. If such is the case, treat as a Load and Go. Prompt extrication, first aid and medical intervention will often be lifesaving. This must be done while keeping in mind the need to prevent further injury.

Thermal injury

In thermal injury, the respiratory tract is injured by the introduction of superheated air or steam.

Such injuries usually occur in an enclosed space, and occasionally in association with forest fires. The superheated air or steam may injure the outside or inside of the mouth and nose, throat, vocal cords, trachea, bronchi, or even the lungs. The damage is essentially a burn wound, and may rapidly become life-threatening.

After the injury has occurred, there is no effective way to limit a deterioration in the patient's condition: thermal injury can cause swelling of the airways, and may lead to fluid developing in the lungs (pulmonary edema). You must recognize this as a priority injury and initiate a rapid Load and Go. Administer high-rate oxygen and perform artificial respiration if necessary.

Signs and symptoms of thermal injury:

- burns about the face and mouth
- singed nasal hairs
- soot in the nose and mouth
- shortness of breath
- wheezing
- coughing up soot tinged sputum
- raspy, course breathing (stridor)
- muffled voice
- drooling
- difficulty in swallowing
- a swollen tongue
- agitation

Smoke injuries

Smoke is composed of soot and various chemicals. The immediate treatment is removal of the patient from the hazardous environment. Then any burning clothing must be removed or extinguished. If available, oxygen should be administered at a high flow rate with a non-rebreather mask and the patroller should provide assisted ventilations, if required.

Difficulty in breathing may not be evident for several hours after the exposure. All patients should be transported for medical evaluation even if they initially appear stable.

Electrical burns

Flash burns

Flash burns are the result of an electrical short circuit producing an arc of intense heat causing direct surface burns.

Contact burns

Contact burns are those in which the body completes the circuit between an electric wire and the ground. Contact burns occur between the points where the current enters the body (entry wound) and leaves it (exit wound).

Contact burns are associated with an electric shock which may be more dangerous to the patient than the burn.

(see "Electrical shock")

The extent of the damage is usually much greater than just the area of contact especially at the exit point. If the patient is still in contact with the current, do not touch them, or the source of electricity until the current has been shut off by the proper authorities.

If you attempt a rescue without having the current shut off, you are exposing yourself to a grave risk to your own life.

Do not approach the area of a downed transmission line, since the high-voltage current may be propagated along the ground. When high-voltage transmission lines are involved, the power company must be called.

After the patient has been rescued and the vital signs maintained, give general first aid for burns. Transportation to medical aid is mandatory, as there may be other concealed damage.

Electrical shock

Electrical shock can be caused by contact with, or proximity to, high-voltage power lines; but it can also be caused by the lower voltage used in industrial and house wiring. The current usually travels through the nervous system and through the heart. This may cause a range of effects - anywhere from a mild electrical shock to respiratory arrest, or cardiac arrest.

When a cardiac arrest occurs, you must maintain CPR until an AED can be applied.

In the case of electrical shock from a high voltage wire, the patient is usually thrown away from the wire. In some cases, however, muscle spasm can cause the patient to freeze to the source. In this case you must make sure that the power is shut off.

In addition to its effect on the heart and the nervous system, electrical shocks may cause serious burns or wounds at the entry and exit points. If the patient was forcibly thrown from the wire, suspect a potential spinal problem and fractures, and treat accordingly.

Signs and symptoms of electrical shock:

The patient may:

- be thrown to the ground and/or rendered unresponsive
- have fractured limbs, caused by the violence of muscle spasms or associated falls
- experience violent muscular spasm
- have paralysis of the limbs
- is unable to speak, followed by amnesia
- have an entrance and exit wound

Treatment for electrical shock

1. Give oxygen, if available.
2. If unresponsive but breathing and spinal problems are not anticipated, place in recovery position.
3. Monitor vital signs closely.
4. Apply AR/CPR, if required.
5. Treat for burns if any (see "Electrical burns")
6. Transport to a medical aid facility.

Lightning strike

Lightning is caused by violent vertical air currents associated with the development of thunderheads. These produce large differences of electrical potential between clouds or the cloud and the ground. The average voltage may be of the order of 10- to 20- million volts, but the duration of the lightning bolt is much shorter (of the order of 0.1 to one milliseconds). The duration is so short that often little energy is delivered to the body, and therefore tissue damage and burns tend to be minor. The major effects are cardiac and respiratory arrest. The fatality rate is about 30 per cent.

The patient may be injured by a direct lightning strike, by ground currents, or by side flashes from nearby strikes. The most serious consequence of a strike is that the electrical current found in the proximity to a lightning strike may easily disrupt the normal rhythms of the heart or even stop it. The lightning strike may also explode clothing from the patient's body by instantly converting moisture to steam; therefore steam burns may also occur.

Signs and symptoms of a lightning strike:

- respiratory arrest
- cardiac arrest
- unresponsiveness
- nervous system changes, such as paralysis or seizures
- shock-like signs
- fern-leaf-like burn pattern
- burns from clothing

Treatment for a lightning strike:

1. Watch for further lightning strikes.
2. Be prepared to give basic life support.
3. Consider the possibility of spinal injuries and other trauma from the fall.
4. Apply oxygen if available.
5. Monitor and record vital signs frequently.
6. Consider all lightning strikes as Load and Go and transport to a medical aid facility as soon as possible.

Sunburn or ultraviolet light exposure

A major sunburn (extreme exposure to ultraviolet light) can make a patient quite ill.

Treatment for sunburn or ultraviolet light exposure:

1. Cool the burned area and protect it from further injury by applying a damp dressing.
2. If no other injury exists, encourage a sunburn patient to take fluids orally to replace lost fluid.
3. An application of a commercially available over the counter first aid lidocaine spray (e.g. Solarcaine); a local topical anesthetic, can be offered to relieve pain, prevent infection and promote healing.
4. Transport to medical aid if:
   - the burn covers a considerable area
   - there are blisters
   - the patient develops a fever

Conclusion

Many cold exposure injuries are the result of a failure to take proper precautions, whether this involves winter activities, water immersion, or chronic hypothermia. Most cold exposure injuries can be prevented by using common sense with the understanding of the mechanism of heat loss which will greatly help in preventing such injuries.

In hypothermia, the treatment differs substantially between a mild and moderately hypothermic patient, and a patient who has severe or critical hypothermia. In the first case, re-warming is the treatment of choice. In the second case, re-warming is contraindicated; instead, the patient should be kept at a constant temperature. It is therefore most important to understand the difference in the signs and symptoms of the various stages of hypothermia.

Once again, in the case of heat injuries, prevention is key. The patroller can help prevent heat injuries by pointing out the risks of heat-related illnesses and the importance of adequate fluid replacement on hot and humid days.

Heat stroke is a life-threatening condition. The patroller must be familiar with the signs and symptoms of heat stroke, be aware of the progression from heat exhaustion to heat stroke, and be prepared to act quickly.

Proper first aid treatment of burns will prevent infection, relieve pain, and maintain blood volume. Consider burns as an emergency potentially leading to the onset of shock.

18. Poisoning and problematic substance use

Learning outcome:

Recognize, understand, and explain the treatment of poisoning, drug and medical misuse.

Upon completion of this chapter you should be able to:

1. Recognize the signs, symptoms and explain the treatment for poisoning, drug and medical abuse.
2. Demonstrate the treatment for the conditions found in this chapter.

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Poisoning

Not all first aid injuries are obvious. Poisoning (below) and drug abuse (see “Problematic substance use ") are less obvious and potentially life-threatening situations. Poisoning can occur in any one of four different ways:

- ingestion (see "Ingested poisons")
- inhalation (see "Inhaled poisons")
- injection (see "Injected poisons")
- absorption through the skin (see "Absorption (surface contact) poisons")

Poison may enter your body the same way it entered your patient's body.

Self-contamination is especially true in cases of absorption or inhalation poisoning.

Always attempt to establish the nature of the poisoning agent before taking action that could endanger yourself or others. Remember, you will not help the situation if you, or others, are endangered or disabled. **In fact, you will have created more patients.**

Be especially careful in administering AR or CPR if there is any possibility of poisoning agent on the lips, vomiting of poison, or exhalation of poisonous gases.

There is an almost infinite number of compounds that can cause poisoning.

Poisoning

CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI

Common examples of poisons include:	General signs and symptoms:
• pesticides • herbicides • gaseous compounds • medicines • household cleaning products • plants • paints • burning plastics • specific poisons • perfumes • some foods	• nausea • vomiting • abdominal pain • constriction or dilation of pupils • excessive salivation • excessive sweating • abnormal respirations or pulse • loss of consciousness • convulsions

Caution: Several types of poisoning can lead to cardiac arrest.

General treatment for poisoning

Your greatest asset in treating a patient who has been poisoned is the ready access to the resources of a poison control centre. Patrollers should have their local poison control centre's number readily available. To effectively handle the situation, the centre will need to know the following:

1. What is the poisoning agent?
2. How much was taken?
3. The mechanism of poisoning?
4. The patient's vital signs?
5. Was the poison:
    - ingested?
    - inhaled?
    - injected?
    - absorbed through the skin?
6. How long ago was the poison taken?
7. What is the present status of the patient?

Procedures for handling cases of poisoning

There are two procedures for handling poisoning, depending on whether the patient is conscious or unresponsive.

Unresponsive patient

- Do not give fluids or induce vomiting
- Check vital signs

If vital signs are normal or stable:

1. Determine the poisoning agent.
2. Call the poison control centre.
3. Monitor the vital signs frequently.
4. Transport as a Load and Go.

If ABCs are compromised:

1. Determine the poisoning agent.
2. Call the poison control centre.
3. Perform AR or CPR (with appropriate barrier device).
4. Continue resuscitation.
5. Transport as a Load and Go.

Conscious patient

Check their vital signs, and do the following:

1. Determine the poisoning agent.
2. Call the poison control centre.

3. If directed, induce vomiting.
4. Monitor the vital signs frequently.
5. Transport as a Load and Go.

Collect any vomitus for laboratory analysis. Transport any containers that may have held the suspected poisoning agent with the patient. Without early identification of the poison, treatment may be delayed. Any delay will be detrimental to the patient.

Ingested poisons

Ingested poisons are poisons introduced into the body orally (swallowed).

Signs and symptoms

Please see "General signs and symptoms".

Treatment

1. Monitor vital signs.
2. Ensure that the airway, breathing and circulation are maintained.
3. Identify the poison and the amount, if possible.
4. Call the poison control centre.
5. Follow the directions given by the poison control centre.
6. Transport to medical aid.

Induce vomiting only if directed by the poison control centre.

Do not induce vomiting if:

- The patient is unresponsive or convulsing.
- The poison is a known corrosive agent such as:
  - acid
  - lye
  - drain cleaner
  - a poison that contains petroleum distillates such as kerosene, gasoline, oil, lighter fluid, or liquid furniture polish
  - if it has caused burns to the lips, mouth or throat

Inhaled poisons

Inhaled poisons are poisons introduced into the body through the respiratory system (breathed in). The most common cases are those of carbon monoxide poisoning.

Signs and symptoms

In addition to the general signs and symptoms of poisoning (see "General signs and symptoms"), other signs and symptoms include:

- respiratory distress
- coughing
- pain and burning in the throat
- pain in the chest
- cyanosis

Treatment

1. Remove the patient from the contaminated atmosphere as quickly as possible with the least amount of risk to yourself and others.
2. Check and monitor vital signs.
3. Ensure that the airway, breathing and circulation are maintained.
4. Initiate artificial respiration/cardiopulmonary resuscitation as necessary.
5. Administer oxygen, if available.
6. Identify the poisoning agent, if possible.
7. Contact the poison control centre and follow their instructions.
8. Transport to medical aid.

If the environment is unsecured (unsafe), do not intervene, call emergency services, such as the fire department, and inform them of the situation.

Injected poisons

Injected poisons are poisons introduced into the body via a break in the skin. See also Insect stings and Snake bite.

Signs and symptoms

- confusion
- disorientation
- delusions
- pain
- tenderness at the site of entry
- swelling at the site of entry
- unresponsive
- diminished function or failure of the respiratory or circulatory systems

Treatment

1. If swelling is apparent, remove all rings, watches and jewelry from the affected limbs.
2. Monitor vital signs.
3. Identify the poisoning agent, if possible.
4. Call the poison control centre.
5. Follow the directions given by the poison control centre.
6. Transport the patient to medical aid.

Absorption (surface contact) poisons

Absorption poisons are introduced into the body through the skin, often with no visible sign of entry. Some poisons can penetrate the unbroken skin. Common absorption poisons include:

- pesticides
- herbicides
- corrosives
- acids

- alkalis
- some petroleum distillates

Absorption

Signs and symptoms of absorption:	Treatment for absorption:
• nausea • sweating • skin irritation • burns • abdominal and substernal tightness • abdominal cramps • profuse salivation • respiratory distress • muscle twitching • seizures • paralysis	1. Call the poison control centre. 2. Follow the directions given by the poison control centre. 3. Protect yourself from skin contamination by the same agent, wear gloves and other barrier devices as appropriate. 4. Identify the poison. • If the poison is solid or in granular form, remove as much of it as possible by brushing before washing with water. 5. Remove the agent from continued skin contact: • Remove any contaminated clothing from the patient. • Wash the area with copious amounts of water including directing a stream of water under the contaminated clothing as it is being removed. 6. Transport the patient to medical aid.

Caution: Always check if the substance could react to water. The poison control centre will provide you with instructions.

Poisonous plants

Toxic plants such as poison ivy, poison oak and poison sumac grow throughout much of North America. The reaction caused by poison ivy, poison oak and poison sumac (urushiol-induced contact dermatitis) is an allergic reaction. Most people will become sensitized with repeated or more concentrated exposure.

It can take from 24 hours to 10 days for a rash to first appear. The rash persists typically one to two weeks and in some cases up to five weeks. Since this is an allergic skin reaction, people may develop progressively stronger reactions after repeated exposures. Reactions can progress to anaphylaxis.

Signs and symptoms

- itching
- inflammation (skin blisters)
- oozing
- burning sensation

Urushiol-induced contact dermatitis is contracted by contact with a plant or any other object containing urushiol oil. A simple skin exposure is most common, however ingestion can lead to serious, more systemic reactions. Burning plant material can create urushiol-laden smoke that causes systemic reaction as well as a rash inside the throat and on the eyes.

Treatment

If contact with urushiol has been made, contact must be stopped as quickly as possible.

1. Cleanse exposed areas with rubbing alcohol.
2. Wash the exposed areas with water only (no soap yet, since soap can move the urushiol, which is the oil from the poison ivy that triggers the rash).
3. Wash the area with soap and warm water.
4. Wipe everything that may also have contacted the plant, including shoes, tools, and clothes, with rubbing alcohol and water.

If a rash develops:

- For milder symptoms, refer patient to a doctor. Cooling with an ice pack can reduce inflammation and soothe the itch.
- For more severe signs of anaphylaxis along with a rash, follow the protocol for treating anaphylaxis and transport to medical aid immediately - Load and Go.

Jellyfish stings

This section applies to jellyfish found on Canada's east and west coasts. Do not touch jellyfish, even if they are lying on the beach. Wear protective gloves when treating a patient.

Signs and symptoms of jellyfish stings

A sting directly to the eye may cause severe pain, tearing, redness, swelling of the eyelids and potential injury to the cornea.

Stings to the skin cause immediate pain and may last for several hours. Small raised blanched bumps or welts develop and the area may become reddened.

Treatment for jellyfish stings

Do not flush the sting area with fresh water, alcohol or urine, as these may cause firing of stingers.

Call the local Poison Control Centre for further advice.

For stings directly to the eyes:

Flush the eyes with salt water for 15 minutes. Recommend that the patient go to a medical facility for an ocular exam and assessment.

Young children may be wrapped in a towel with arms at their sides and held over the sink or tub or laid on a counter during flushing.

For stings to the skin:

1. Flush the area with salt water for 15 minutes.
2. After flushing the area, remove any remaining tentacles by scraping with a plastic card or a dull knife edge.
3. Caution the patient not to rub the sting site.

Insect stings

Stings from insects such as bees, wasps, hornets, ticks and spiders are prevalent particularly during the warmer months and are more common among children. The body reacts to insect

stings on two different levels, local and systemic. Most individuals stung by an insect have only a local reaction.

Local response

Signs and symptoms of a local response:

- pain
- redness
- itching
- swelling in the form of a raised, firm welt
- possible broken skin with bites

Treatment for a local response:

1. If the sting was induced by a bee, carefully scrape the injection site in order to remove the stinger and its attached venom sac, if it is present.
2. Apply an ice pack to reduce inflammation and pain. Usually no further treatment is necessary

Systemic response

In approximately five per cent of the population, a generalized systemic reaction occurs with insect stings, particularly bee stings. The patient in these cases displays an acute allergic reaction to the venom, known as anaphylaxis. In anaphylaxis, death can occur within as little as five minutes from the time of the sting. These people may have their medication with them and may require assistance (see "Anaphylaxis"). Be prepared to deal with breathing problems.

Signs and symptoms of a systemic response:

- difficulty breathing
- swelling (particularly about the throat, tongue, eyes and nasal passages)
- skin welts, or hives
- generalized itching
- weakness
- headache
- abdominal pain
- anxiety
- restlessness

Treatment for a systemic response:

1. Provide life support as indicated by checking and monitoring vital signs and assist the patient with taking their own medication if necessary.
2. If the stinger with its venom sac is present and visible, carefully scrape it from the skin. If it is a tick bite, grasp the tick with tweezers as close to the skin as possible. The tweezers should be held at a right angle to the main axis of the tick's body. Gently pull the tick away from the host's skin. Avoid twisting or turning the tick during removal. Examine the tick to ensure that it has been completely removed.
3. Apply an ice pack to the area to reduce pain and local blood flow.

4. If possible, collect and transport any insect that may be the source of the bite for identification purposes.
5. If possible, cleanse the area with saline solution or soap and water. Apply dressing if necessary.
6. Transport the patient without delay to a medical facility.

Snake bite

In North America there are four groups of poisonous snakes:

- copperheads
- coral snakes
- rattlesnakes
- water moccasins

In Canada, the most serious threat is from rattlesnakes. The venom of rattlesnakes, copperheads and water moccasins is primarily a hemotoxin. A hemotoxin is a poison that alters normal characteristics of blood, particularly its ability to clot. A coral snake's venom affects the nervous system.

Note that poisoning does not necessarily occur in all incidences of snake bite.

Signs and symptoms of snake bite:

- bleeding under the skin and purplish discolouration after several hours
- blood blisters
- sweating
- vomiting
- rapid pulse
- limb numbness
- weakness
- faintness
- low blood pressure
- severe burning pain and immediate swelling at the bite site, increasing over the next six to eight hours

If no swelling has occurred after one hour, injection of venom is unlikely to have occurred.

Treatment for snake bite:

1. Calm and reassure the patient.
2. Have them lie down and keep them quiet throughout transportation to hospital
3. Do not give them any alcohol.
4. Rings, watches and constricting clothing should be removed, if possible, to avoid a tourniquet effect as swelling progresses.
5. Clean the bite site with soap and water or an antiseptic solution, if available.
6. Immobilize the extremity in a splint to reduce circulation of the toxin by muscular contraction. Do not apply a pressure immobilization bandage. Impeding normal blood flow to the affected limb can increase the severity of local tissue damage.

7. Check and monitor vital signs. Ensure that the ABCs are maintained.
8. Under no circumstances should an ice pack or cold pack be applied to the area. Some types of snake venom are activated by cold.
9. Transport the patient to medical aid.
10. If possible, advise the medical facility prior to the patient's arrival in order to have the anti-venom ready for them.

Problematic substance use

Problematic substance use is the harmful or hazardous use of psychoactive substances including alcohol, cannabis, prescription drugs, illicit drugs and other substances (e.g., solvents).

Repeated use of psychoactive substances can lead to tolerance, dependence, and addiction. Tolerance is the response of the brain and nervous system to repeated substance exposure, such that higher doses are required to have the same effect. Dependence is the resulting physiological need for continued substance exposure in order to feel “normal. Dependence does not necessarily imply a psychological need for the substance. Addiction implies ongoing use in the face of loss of control, craving, adverse consequences, and expressed concern and criticism.

Withdrawal occurs when a dependent individual stops using the substance on which they are dependent. For example, physical symptoms such as nausea, vomiting, tremors, chills, sweating, and altered heart rate or blood pressure may develop within a few hours of stopping use of an opioid by a dependent individual.

Tolerance occurs with repeated use, and manifests as a need for higher and higher doses of a substance over time to produce a similar desired effect. This means that the dose required to produce a desired effect in a dependent individual may be much greater than what is considered to be “normal” or “typical” in a person who is not dependent.

Intoxication refers to changes in the level of consciousness, cognition, perception, judgement, affect (emotions) and/or behaviour that occur after administration of a psychoactive substance. The amount (dose) of a substance required to produce a state of intoxication is influenced by a person’s degree of tolerance, among other factors.

Route of administration

Intoxication may occur after orally ingesting, smoking, injecting, snorting or inhaling a particular psychoactive substance. Some substances may also be absorbed through the skin either intentionally (e.g. patch medications) or inadvertently which can pose a risk to first responders. Always wear personal protection to prevent inadvertent absorption.

Central Nervous System (CNS) depressants

- CNS depressants are associated with a depressed mental status, reduced respiratory rate and depth, and decreased pulse rate and blood pressure
- Examples of CNS depressants include diverse substances such as alcohol, sedatives and sleeping pills (e.g., benzodiazepines), and opioids (e.g., morphine, heroin, fentanyl)
- Opioid intoxication can be associated with respiratory arrest

Central Nervous System (CNS) stimulants

- CNS stimulants are associated with agitation or aggression, seizures, increased pulse rate, blood pressure, respiratory rate and temperature
- Examples of CNS stimulants include cocaine and amphetamines (e.g. crystal meth)

- Cocaine intoxication may result in angina and myocardial infarction

Signs and symptoms of intoxication:

Signs and symptoms of intoxication vary with the substance. Assess vital signs and monitor for trends in vital signs that indicate deterioration in clinical status. Remain alert to indications of substance usage, which may include:

- altered mental status (agitation, sedation, confusion)
- bizarre, atypical, aggressive or belligerent behaviour
- slurred speech
- motor incoordination and unsteady stumbling gait (ataxia)
- tremor or seizures
- characteristic odour (e.g., alcohol, glue or solvent odour)
- pinpoint or markedly dilated pupils
- involuntary horizontal eye movements (nystagmus)
- unusual heart rate (rapid or slow)
- unusual respiratory rate (rapid or slow)
- unusual blood pressure (high or low)
- red eyes (conjunctival injection), typical of marijuana use
- cyanosis
- profuse sweating

The presence of one or more of these symptoms in isolation does not necessarily imply that a person has been using a substance. It is important to keep an open mind and not jump to conclusions. For example, a confused or disoriented person with slurred speech may be a diabetic patient with hypoglycemia rather than a person with alcohol intoxication.

While it is desirable to identify the substance that is causing a person's symptoms, this is not always possible, either because the patient is unresponsive or because they do not know the identity of the substance to which they have been exposed.

It is not necessary to have a comprehensive knowledge of drugs in order to render first aid to an intoxicated person. What is important is that the patient is carefully assessed, basic life support is initiated if indicated, and the individual is transported to medical aid without delay.

Be vigilant

Protect yourself and others from danger during encounters with intoxicated persons.

Do not approach if the person is aggressive or violent.

Wear personal protection and avoid exposure to contaminated objects (e.g., syringes) or unidentified substances discarded at the scene.

Treatment of intoxicated individuals

Conscious (responsive) patients:

1. Introduce yourself, obtain consent and try to initiate a conversation.
2. Attempt to establish the person's state of mind.

3. Establish a rapport with the person and attempt to calm them down if they are anxious or agitated.
4. Identify the causative substance and when and how it was ingested.
5. Assess vital signs.
6. Request assistance if needed.
7. Document your observations.
8. Arrange transport to medical aid if warranted.

Comparative effects on vital signs and acute intoxicating effects of opioids (CNS depressant) and cocaine (CNS stimulant)

	Opioids (e.g. morphine, heroin, fentanyl)	Cocaine
Routes of administration or absorption	Oral, intranasal (snorting), smoking, injection, transdermal (through the skin)	Intranasal, smoking, injection
Respiratory rate	↓↓	↔ or ↑
Pulse	↔ or ↓	↑↑
Blood pressure	↔ or ↓	↑↑
Skin	Pale, moist, cool	Moist, warm
Pupils	Pinpoint .	Enlarged ◯
LOC	May be unresponsive	Alert
Neuro-muscular	Coma, decreased reflexes	Headache. tremor, seizures
Other	Nausea	Hyperthermia
Adverse behavioural effects	Sedation	Anxiety, irritability, panic attacks, suspiciousness, paranoia, grandiosity, impaired judgment, and psychotic symptoms (delusions and hallucinations)
Potential lethal effects	Respiratory arrest	Stroke, myocardial infarction, arrhythmias

↓, decrease; ↓↓, marked decrease; ↑, increase; ↑↑, marked increase ↔, no change

Unresponsive patients:

1. Assess vital signs.
2. Provide basic life support (AR, CPR) if indicated.
3. Activate EMS. (an LOC of unresponsive is a Load and Go situation)
4. Question bystanders to establish the potential substance involved and the sequence of events.
5. Document your observations.
6. Transport the patient to medical aid.

Antidotes

Specific antidotes (reversal agents) are available for certain intoxicants.

Patrollers in some jurisdictions may receive training through provincially-endorsed programs in the use of naloxone, which is a specific antidote for opioid intoxication (e.g., morphine, heroin, fentanyl). Area-specific protocols should be followed when administering naloxone.

If the respiratory rate is less than 8, administer naloxone (if available).

Overdose / misuse

All opioids (e.g., morphine, fentanyl and heroin) impair breathing and may cause patients to stop breathing. Shortly after this happens, the patient may also go into cardiac arrest. Depending on the length of respiratory distress or arrest or cardiac arrest, brain damage may be irreversible and death may occur. Patients who restart opioid use after a period of abstinence are at particularly high risk of overdose as they will have lost their tolerance to high doses and may restart using opioids at their previous high dose.

Naloxone (Narcan)

Naloxone may be given as an intranasal spray or injection. Naloxone has greater affinity for receptors in the brain than opioids, and thus temporarily displaces the opioid, which then allows the restoration of respiration. After receiving naloxone, patients will usually start to breathe spontaneously within a few seconds, if given intravenously, to a few minutes, if given intramuscularly or intranasally, depending on the type and amount of opioid absorbed. More than one dose of naloxone may be required to restore respiration. If the patient has not responded within two to three minutes, give another dose. All overdose patients should be sent to a hospital because naloxone generally has a shorter duration of action than opioids; thus it is likely that the effect of naloxone will wear off and the opioid will cause the patient to stop breathing again.

Adverse effects of naloxone

Naloxone has few adverse effects nonetheless allergic reactions to naloxone are possible, but very rare. Naloxone can provoke opioid withdrawal in patients who are frequent users of opioids. This includes signs and symptoms such as anxiety, nausea, sweating, muscle cramping, and/or acute pain if the patient has been taking the opioid for pain relief. Patients may be angry and belligerent as they experience the cessation of the desired euphoric effect.

Monitoring patients after administering naloxone

Once spontaneous respiration is restored stay with the patient until paramedics arrive. Monitor the patient for the following:

- vomiting (if supine, place the patient in the recovery position)
- aggressive or violent behaviour (protect yourself and others from danger)
- disorientation (explain what has happened)
- continued respiratory distress and low oxygen saturation (monitor oxygen saturation and respiratory rate.

Support with oxygen, if O2 saturation falls below 94 per cent, or assist with breathing if respirations fall below 8). The dose should be repeated at two to three minute intervals if the patient does not begin to breathe spontaneously. (There is no limit to the number of doses that are to be given). If the patient does not regain consciousness and is unable to protect their airway, place the patient in the recovery position and continue to monitor until handed over to EMS.

Opioid overdose

Qualified individuals who have naloxone available and are trained in its use, may administer it.

Basic life support (AR/CPR/AED) should not be delayed to administer naloxone.

1. Activate EMS.
2. Start AR / CPR.
3. Give naloxone, if available.

First aid and naloxone administration are not a substitute for advanced medical care. All people who receive naloxone should be sent to an emergency department.

The availability of naloxone and naloxone training varies by province and region.

Cannabis / marijuana

Although an overdose of cannabis is rare, overuse can result in severe heath affects leading to death. Deaths associated with cannabis usually occur in the setting of combined drug use or in patients with medical conditions, and are not attributable to cannabis alone. Street-sourced cannabis can be contaminated with drugs such as opioids (e.g., fentanyl) or toxic moulds.

Cannabis is more potent than it was years ago, which increases the risk of accidental overuse. Users who eat edibles may consume more cannabis than intended since they must be digested and the onset of intoxication is delayed.

Smoking versus eating

Peak drug levels in blood are reached within 3 to 10 minutes after smoking or vapourizing cannabis, and 30 minutes to 3 hours after eating cannabis. Moreover, the duration of intoxication can last from 3 to 10 hours after eating cannabis. This can lead an individual to inadvertently ingest more cannabis than they would usually smoke, because they think that it is not working, only to realize later that they have consumed too much. The longer duration of effects of ingested cannabis (three to ten hours) can also lead to other problems since the effects persist much longer than when smoked or vaped. Ingested cannabis may also have a wide range of cannabis concentrations, depending on the source plant and preparation method. This can lead to unpredictable dosing and individual responses.

Cannabis can cause heart palpitations and cardiac arrhythmias, and the risk of a heart attack is increased over one hour after using cannabis.

First aid treatment for cannabis overuse or overdose

The symptoms of a cannabis overdose can be felt for several days. Some people liken it to the effects experienced after binge drinking. The treatment is symptom-based. Severe symptoms need immediate medical attention. Treatment options include:

- prevent the user from injury
- rest
- hydrate
- seek medical attention if symptoms do not improve or worsen

Short term effects of cannabis/ marijuana

- euphoria
- relaxed state, sleepiness
- dry mouth
- increased appetite
- short-term memory loss
- impaired judgment
- distorted perception
- slowed coordination
- panic attacks
- disorientation
- temporary and extreme paranoia, fear and anxiety
- trouble breathing
- pupil dilation
- fast pulse
- shaking chills
- unconsciousness
- nausea and vomiting
- hallucinations
- mental confusion

Conclusion

When dealing with poisons, the first consideration is your safety. That includes making sure that the air is free of poisonous gases, and that inhaled, ingested, or skin contact poisons cannot harm you. Of special concern are strong poisons that could be on the lips of the patient, in any vomitus, or exhaled from the lungs. In such cases your own protection is vital. You should use barrier devices such as pocket face masks or disposable filters.

While poisoning is not a commonly encountered problem in winter first aid, drug abuse problems are unfortunately surprisingly common. Anaphylactic reactions can occur in any setting and at any time of the year. Treat these conditions appropriately and aggressively, and do not fall into the trap of thinking that someone with an altered level of consciousness, and alcohol odour to the breath, just needs to sleep it off. Regrettably, many of these people will not reawaken.

19. Miscellaneous treatments

Learning outcome:

Recognize, understand, and explain the treatment of miscellaneous injures.

Upon completion of this chapter you should be able to:

1. Recognize the signs, symptoms and explain the treatment for miscellaneous injuries.
2. Demonstrate the treatment for the conditions found in this chapter.

In this chapter:

Eye injuries 325
- Foreign body in the eye 325
- Burns of the eye or eyelid 327
- Lacerated eyelid 327
- Lacerated eyeball 327
- Solar keratitis and flash burns to eyes 328

Ear and nose problems 329
Abdominal problems 329
Childbirth 330
- Preparation 330
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Critical incident stress 333
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Mental health emergencies 334
Decompression illness 336

Eye injuries

Foreign body in the eye

Check for contact lenses, especially with an unresponsive patient. If found, do not remove the lenses but record their presence to inform hospital personnel.

Only those foreign bodies lying on the surface of the eyeball can be removed safely by the patroller. An unskilled attempt at removing an embedded particle may result in severe damage to the eyeball or in extreme cases, blindness.

Signs and symptoms of an embedded object or a loose foreign body are the same but treatment differs substantially. An embedded object must be referred to medical aid.

Signs and symptoms of foreign body in the eye:

- redness of the eyes
- irritation
- tearing eyes
- pain
- visible presence of a foreign body embedded in, or on, the patient's eyeball

Treatment for a loose foreign body

1. Tell the patient not to rub the eye.
2. Wash your hands thoroughly before examining the eye.
3. To dislodge the particle do the following:
   - Have the patient grasp the lashes of the upper lid gently.
   - While looking down, the patient should pull the upper lid forward and downward over the lower eyelid.
   - This may dislodge a particle under the upper eyelid sufficiently to be washed away by the tears.

Figure 19-1: Grasp the lashes of the upper lid gently.

4. If method one above fails, the foreign body must be located first by looking under the lower eyelid:
   - Look under the lower lid. With the patient facing a window or a light, place your thumb near the edge of the lower lid and pull downward, while the patient looks up.
   - If a foreign body is found, it may be removed with the corner of a clean handkerchief, cotton swab, sterile gauze or folded edge of a fresh tissue.

5. If method two above also fails, the foreign body must be located first by looking under the upper eyelid:
   - Prepare a cotton-tip applicator. If none is available, use a wooden match, its tip wrapped with cotton wool.
   - With the eye closed, grasp the lashes of the upper lid firmly between the thumb and first finger and pull down and away from the eyeball.
   - Instruct the patient to look down.
   - Place the applicator across the outer surface of the upper lid about halfway down, and press downward lightly.
   - Pull the lid out and up over the applicator. This folds the upper lid back over the applicator, and the inner surface may be clearly seen.
   - If a foreign body is present, it may be removed with the corner of a clean handkerchief, cotton swab, sterile gauze or folded edge of a fresh tissue.

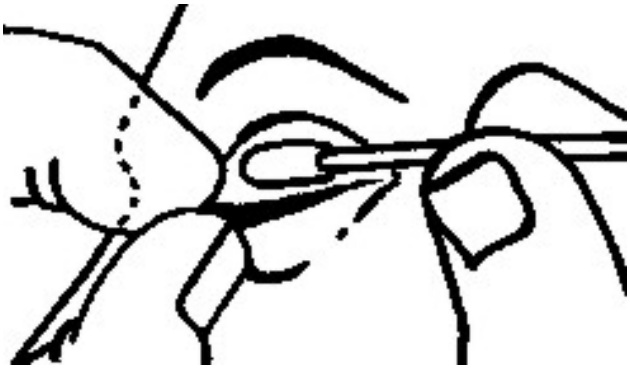

Figure 19-2: Placing the applicator on the upper eyelid.

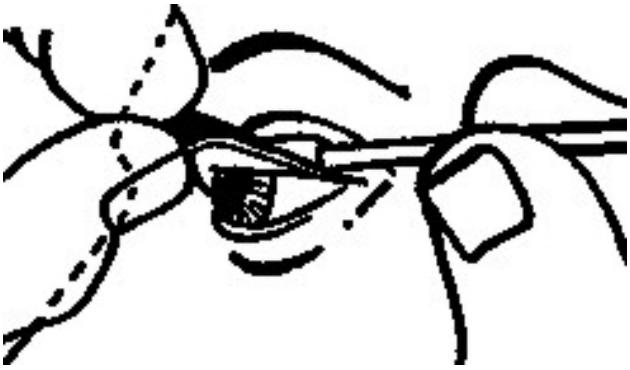

Figure 19-3: Pulling the upper eye lid out and over.

6. If the above measures fail, treat as a lacerated eyeball and transport the patient to medical aid immediately. (see "Lacerated eyeball").

Treatment for an embedded object

1. Tell the patient not to rub the eye. Rubbing scratches the eye membrane and may drive the particle (embedded object) deeper into the tissues, making its removal more difficult.
2. Wash your hands thoroughly before examining the eye.
1. You may inadvertently transfer dirt from your hands into the eye.

3. Be gentle and cautious when examining the eye. Eyes are easily damaged.
4. Do not attempt to remove the embedded particle.
5. Cover the eye with a dressing.
6. Transport to medical aid.

Burns of the eye or eyelid

Burns to eyes or eyelids occur as a result of chemical reactions (e.g. contact with acid) or heat (e.g. flame).

Signs and symptoms of a burn to the eye or eyelid:

- redness
- charred appearance of the skin
- severe pain
- reduced vision

Treatment of chemical burns:

1. Dilute the chemical immediately, by flushing the eye with water or an already prepared or manufactured sterile saline solution.
2. It may be necessary to hold the patient's eyelids open.
3. Flush the eye for at least 20 to 30 minutes. If possible, continue flushing en route, preferably using sterile saline solution.
4. Apply a moist dressing and transport the patient to medical aid immediately.

Treatment for thermal burns

When suffering burns of the face from a fire, a patient's eyes usually close rapidly because of the heat. This reaction is a natural reflex to protect the eyeballs. However, the eyelids remain exposed and are frequently burned.

The treatment of burned lids requires specialized care, therefore apply moistened sterile dressing and transport the patient to medical aid immediately.

Lacerated eyelid

Lacerations to the eyelid often occur in conjunction with serious injuries to the face or eyeball (see Lacerated eyeball, below).

Signs and symptoms of a lacerated eyelid:

- profuse bleeding due to the rich blood supply

Treatment of a lacerated eyelid

1. Apply pressure directed upwards against the forehead.
2. Do not apply direct pressure to the eyeball.
3. Transport the patient to medical aid immediately.

Lacerated eyeball

Lacerations to the eyeball may occur either as a single injury, or along with multiple injury sites such as broken bones.

This can be a very serious injury if fluid is lost from the inside of the eyeball. Ensure that the patient is transported comfortably and that nothing increases the pressure on the eyeball, for example, sudden movement, coughing, or tight dressings.

Signs and symptoms of a lacerated eyeball:

Signs and symptoms include pain at and around the site of the wound, bleeding, or the presence of tearing in the eye.

Treatment for a lacerated eyeball:

1. Do not exert pressure on a lacerated eyeball. This could force fluid out of the eyeball.
2. Do not remove a protruding foreign body from the eye.
3. Pad around the eye and cover with a dressing.
4. Transport the patient to medical aid immediately.

Solar keratitis and flash burns to eyes

Flash burns to the eye cause inflammation of the cornea, which can lead to searing pain and the feeling of having sand in the eyes. A flash burn occurs when the eye is exposed to bright ultraviolet (UV) light from a variety of sources, including:

- direct sunlight
- reflection of the sun off water or snow
- welding torch
- sunlamp in a tanning salon
- some types of lamps, such as halogen or a photographer's flood lamp

Overexposure to the sun's UV rays, either direct or by reflection, is called solar keratitis. If the reflections are from the snow it is commonly known as snow blindness. Flash burns are like sunburn in the eye and can affect both eyes. The cornea can repair itself in one to two days and usually heals without leaving a scar. However, if a flash burn is not treated an infection may start. This can be serious and may lead to some loss of vision.

Prevention

Prevention is the best method of treatment. Wear dark glasses or sun goggles. Improvise goggles with a cardboard disk or leather. Slit the cardboard or leather in the form of a T (one for each eye) and place over the eyes.

Signs and symptoms

- blurred vision
- irritation
- burning sensation increasing to intense pain
- redness of the eyes
- eyelid twitching
- swelling
- sensitivity to light
- tearing eyes
- temporary vision loss (called photo keratitis, or snow blindness)

Similar signs and symptoms can be experienced or exacerbated when an irritating substance like sunscreen and sweat get transferred into the eyes. These substances can temporarily irritate the delicate membrane over the eyeballs, making them sting or burn.

The treatment for sunburned eyes and foreign substances like sunscreen or sweat in the eyes is the same.

Treatment

1. Move patient to a shaded, cool location, preferably indoors and seated.
2. Caution the patient not to rub their eyes.
3. Check if patient is wearing contact lenses and, if applicable, have the patient remove them. If unable to remove a contact lens, flush the eye with the contact lens in.
4. Assist the patient to hold the eye lid open and flush the eye with saline or commercially available eyewash solutions. In lieu of saline, use cool water and continue with treatment as outlined. Flush the eye from the inner corner toward the outer corner. This prevents a substance in the eye from washing into the other eye.
5. Monitor patient. The flushing treatment may have to be repeated several times.
6. Use a light, cool compress or ice towel to reduce the pain. If a small ice pack is used, place a damp cloth (single layer) between the ice and the skin. Do not use chemical cooling packs on the eyes.
7. After flushing the eye, encourage the patient to wear dark glasses or cover the eye with a sterile eye dressing, bandage or cloth. Keeping the eye closed may help reduce pain.
8. If the symptoms last longer than a day, or if they worsen, the patient should seek advanced medical care.

Ear and nose problems

There is little that first aid can do in practice for internal injuries to the ear or nose.

Ear ache

Refer the patient to medical aid.

Foreign body

Refer the patient to medical aid if they have a foreign body in their ear or nose. If a foreign body is present, warn them not to blow their nose.

Abdominal problems

Children often swallow small objects such as coins, pins or tacks. In any of these cases, do not give anything by mouth and refer the patient to medical aid.

Abdominal pain

There are many causes of pain in the abdomen or "stomach," some of which are serious. Refer the patient to medical aid. Make sure it's non-trauma related. If the injury is trauma related, take necessary precautions and treat accordingly.

Childbirth

First aid for childbirth (or, more accurately, assistance with childbirth), requires common sense and professionalism on the part of the patroller.

Preparation

1. One of the first things to do is to ensure privacy for the mother and wash your hands to ensure they are clean and you are wearing gloves.
2. Do not move the mother unnecessarily; lay her in the most comfortable position, preferably left lateral. If transportation is necessary, she should be carried.
3. When the mother is nearing delivery, look for the following:
    - breakage of the membrane which surrounds the fetus in the uterus, resulting in fluid flowing from the birth canal, and uterine contractions.

Contractions are the action of the uterine muscles dilating the birth canal and pushing the baby down and through it, to birth. They are involuntary and are intermittent.

Be aware that at the onset of labour contractions can occur at irregular intervals, and are:

- Relatively mild, and short in duration (30 seconds) occurring at long intervals (often as much as 30 to 60 minutes apart).
- Contractions progress as delivery nears. They become more intense, are longer in duration (50 to 60 seconds), and occur at short regular intervals (as close as two minutes apart), and these contractions continue until the cervix is completely dilated.

Transport the mother to medical aid unless the baby is crowning (the head of the baby is starting to show).

Delivery

Cleanliness, privacy, warmth, comfort and reassurance are all important during the birth process. During the birthing process, all supplies should be kept as clean as possible, ideally sterile. If available, gloves, gown and mask should be worn.

The partner, family members or people who are accompanying the mother may also be a valuable asset.

There are three stages of labour:

First stage of labour

The first stage of labour consists of early labour, active labour, and the transitional phase.

Early labour

Early labour may feel like mild cramps or a dull ache or backache. Early contractions are usually more than five minutes apart and can be as much as 60 minutes apart and short, (30 or 45 seconds long), can come at irregular intervals and also vary in intensity. Early labour may start and stop or it may progress smoothly into active labour. The cervix can dilate up to 3 cm or 4 cm.

Active labour

In this stage, contractions usually start gradually, building up to a peak of intensity before fading away. Contractions may come as often as every three to four minutes and last 50 to 90 seconds and are usually at regular intervals. The cervix opens from 3cm or 4cm to 8cm.

Transitional stage

In this stage, the patient may feel less frequent, but much stronger, longer lasting and regular contractions (up to 90 second contractions, 2 - 3 minutes apart). Sometimes they can come in a double wave. They may peak, start to fade, then increase in intensity again before dissipating. The cervix can dilate up to 10cm.

Second stage of labour

The delivery is the second stage of labour and is defined as the time from which the cervix is fully dilated until the baby is born. Contractions are regular and intense and your patient feels the urge to push. If it has been decided that there is no time to transport the mother to hospital, have someone try to summon a doctor or a person who has had some experience with childbirth.

Third stage of labour

The delivery of the placenta (or afterbirth) is the third stage of labour. It is usually delivered within minutes but may take as long as 30 minutes.

Procedure

1. Place the mother in the position she finds most comfortable - usually on her left side. Ask whether the mother has attended prenatal classes or whether she has a preferred position (such as squatting or kneeling).
2. Place absorbent clean material such as towels under her buttocks, and drape a blanket over her legs.
3. Have someone sit at the mother's head to reassure her and talk to her in a quiet, comforting way. Encourage the mother to relax and not to strain unless necessary.
4. If the mother complains that she has to move her bowels explain that this feeling is caused by the pressure that is exerted by the baby's head.
5. During birth, the contractions change and are called expulsion contractions. The mother will feel the need to bear down and push at this point. This marks the end of the first stage of labour.
6. Encourage the mother to push with each contraction, but not too hard as the top of the baby's head is being born. She should rest between contractions by panting or taking deep respirations.
5. Support the baby's head as it appears. Do not allow it to suddenly drop down from the vagina. Once the head is delivered, clear the baby's airway by stroking the nose to drain mucous and liquids.
    - Look and feel to see whether the umbilical cord is wrapped around the baby's neck. If it is, gently slip the cord over the baby's head if possible.
    - The baby's head will turn towards the thigh and allow the shoulders to be delivered next. As the baby's abdomen shows up, put your other hand under the baby so that it is always held by two hands from that point on.
    - Be careful, the baby is very slippery.
    - Do not compress the baby's neck and do not let the baby's head hang straight down. The baby should breathe on its own right away, and may cry.
    - It should then be wrapped in a clean, dry blanket or cloth and placed on the mother's abdomen with the head lowered to help drain fluids. Do not cut the cord. Keep the baby

warm. This ends the second stage of labour. If the baby appears unresponsive, be prepared to administer infant AR or CPR.

6. After the birth of the baby, expect about 300 to 500 millilitres of vaginal bleeding.
7. Place the placenta in a plastic bag or basin, and take it to the hospital to be examined for completeness; retained pieces of placenta will cause persistent bleeding.
8. Check the lower abdomen to see if the uterus is firm. If the uterus is not firm and the mother is still bleeding, gently massage the abdomen to help it contract. Check the uterus frequently and record its condition with your vitals check every 5 minutes until EMS arrives. The weight of the baby on the mother's abdomen helps the uterus contract and expel the placenta.

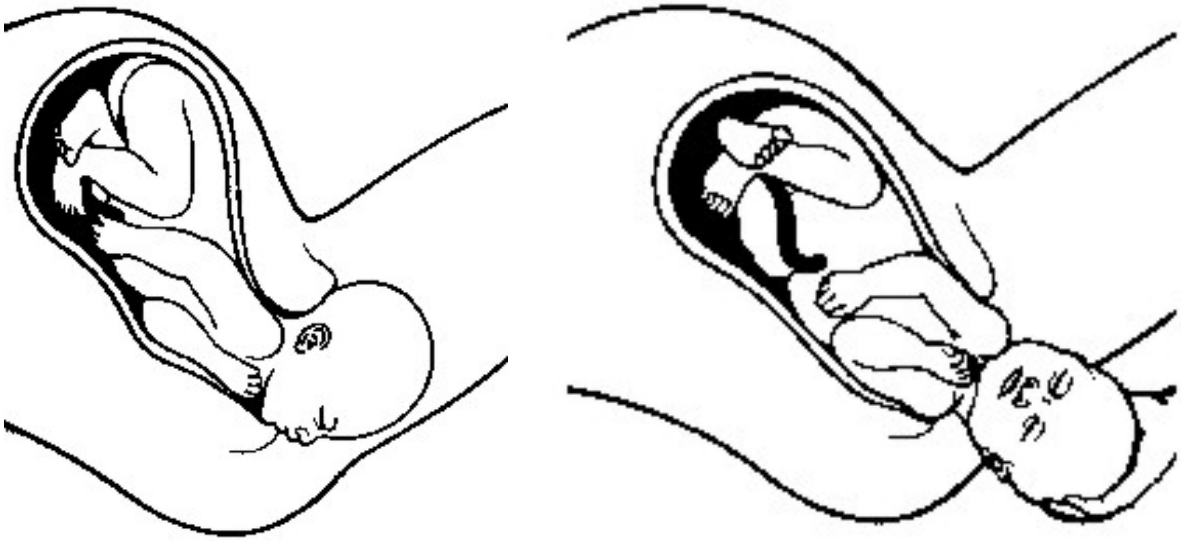

Figure 19-4: Baby's head then shoulders appearing.

Miscarriage

A miscarriage is the spontaneous termination of the pregnancy at any time before the fetus is capable of living outside of the womb. This time is defined in terms of:

- weight of the fetus of 400 grams (14 oz.), or less
- the length of pregnancy is 20 weeks, or less

Signs and symptoms

Although the patient generally knows she is pregnant, signs and symptoms include:

- vaginal bleeding (first sign), which may be slight, moderate or heavy
- cramps, after the bleeding has started
- a combination of both is an almost certain sign of abortion

Treatment

1. Keep the patient at rest and reassure her.
2. Give nothing by mouth (she may require surgery)
3. Observe for signs of shock (pallor, rapid pulse, shallow breathing, coldness).
4. Keep her warm.

5. Preserve clots and tissue passed. This material may be of use to doctors after the patient arrives at medical aid.
6. Transport the patient to medical aid immediately with preserved material.

Critical incident stress

Patrollers possess many of the same characteristics as other fellow emergency workers. These traits include:

- a need to be in control
- a strong desire to do a perfect job
- compulsive, tend to repeat the same actions in very similar events
- highly-motivated by internal factors
- action-oriented
- high need for immediate gratification
- easily bored
- risk takers
- strong need to be needed
- strong sense of dedication

These traits allow patrollers to work effectively in the emergency setting.

During the process of assisting patients, it is natural to have emotional feelings. However, when the emotional reaction is so powerful as to overcome or severely impair your ability to think and act, you experience a personal "critical incident."

Cause of critical incident stress

Critical incident stress (CIS) is defined as a normal response, experienced by normal people to an abnormal event.

Patrollers are often the first people at abnormal events. Critical incident stress is most commonly associated with the following types of incidents:

- death or serious injury of a person
- suicide or unexpected death
- multiple-patient incident
- death of a child (particularly if due to violence)
- serious injury or death of the patient or bystander during a rescue
- situations when there is personal identification with the patient or the circumstances
- any incident that attracts media attention
- when the signs, sounds and/or smell of the incident are so distressing as to produce a high level of immediate or delayed emotional reaction

Signs and symptoms of critical incident stress:

The effects of CIS may be felt at the scene or after the incident is over. CIS can manifest itself either physically, emotionally or in the individual's logical thinking process.

They include physical conditions such as:

- sudden fatigue
- nausea or vomiting
- shock-like symptoms
- twitching or tremors

Thinking process conditions such as:

- memory loss
- inability to clearly identify things by their proper terms
- confusion
- impaired thinking
- reduced attention span

After the incident, you may experience irritability, frustration, difficulty in concentrating, sleeplessness, or flashbacks associated with the incident itself or any personally appalling aspect of the incident, displays of anger and frustration, sadness, or distancing yourself from family and friends. You may become extremely self-critical of personal skills and question the ability to provide help to someone else in the future. All of these feelings are normal following a critical incident and will eventually pass with time.

Treatment of critical incident stress:

The effects of CIS can be greatly reduced by simply talking to another trusted patroller about the incident and the feelings it generated. Talking with the other patrollers who were a part of the incident is even more powerful. The sooner the incident is discussed, the better.

A good time to discuss the day's events is prior to leaving the hill, at the end of the day. A discussion of each incident managed during the day will allow all patrollers to tell their side of the incident and thus provide answers to some of the more gnawing questions. It provides a safe forum to describe feelings, release pent-up or suppressed emotions as well as being an excellent education opportunity.

It is an opportunity to put the incident in perspective. If a discussion is held at the end of each and every patrolling day, it will become a normal routine, rather than a special process to be used only for special incidents. This will help reduce the natural reluctance that patrollers feel in discussing the emotional sides of an incident.

Critical debriefing

When one or several patrollers are involved in a particularly distressing event, it may be possible to provide a critical incident stress debriefing to the patrollers.

A debriefing is an educational process designed to reduce the emotional aspects of the event

Debriefings take place with the help of a specially trained professional. At times, a debriefing team may be required, made up of peer support people and individuals trained both in rescue and the debriefing process. The team can provide the guidance to bring the debriefing to a positive conclusion and provide the monitoring and additional counselling that may be required by members who may be experiencing a more heightened stress reaction.

Emergency workers who talk about their emotions in a debriefing have found that they are better able to manage their feelings and maintain a normal balance in their lives with less impact on their loved ones. They are able to put the event into a more realistic perspective faster than those that have not participated in the debriefing process. Managing the emotional side of incidents will allow you to patrol for a longer time and enjoy it more.

Mental health emergencies

Patrollers may encounter mental health emergencies, either personally or by recognizing a mental health emergency in another patroller or workplace colleague, or in a ski area guest or first aid patient.

Both physical and mental health are affected by many factors, including:

- age and gender

- genetics
- personal history (past trauma, learned coping mechanisms)
- environment
- drugs (prescription, non-prescription, illegal)
- lifestyle (diet, physical activity, sleep, smoking and other substance use)
- support system (relationship status, social supports at home and work, access to healthcare)
- stress (perceived differently by everyone)

Workplace factors associated with how work is organized, and people are managed, as well as incidents of harassment, alienation and bullying, may directly contribute to mental distress (feeling anxious, depressed, burnt out or demoralized). The CSP has a Mutual Respect Policy for how to deal with harassment, alienation and bullying in the patrol environment.

Recognizing a mental health emergency

Mental distress can be a source of considerable suffering and can also lead to the development of a psychological disorder, make an existing disorder worse, or block rehabilitation efforts.

Psychological disorders include:

- **Mood disorders** – experiencing a range of emotions and moods is an important and natural part of life. However, a person who has a mood-related disorder may experience moods and emotions more strongly over an extended period. Common mood disorders include clinical depression, postpartum depression, seasonal affective disorder and bipolar disorder.
- **Anxiety disorders** – a small amount of anxiety can be a useful reaction. However, if anxiety reaches an overwhelming level or remains high for an extended period, it can interfere with an individual's day-to-day life. Anxiety disorders include generalized anxiety disorder, panic disorder, phobia disorders, obsessive compulsive disorder and social anxiety.
- **Trauma disorders** – trauma disorders include acute stress disorder (ASD) and post-traumatic stress disorder (PTSD), typically resulting from witnessing or experiencing an extremely distressing or catastrophic event, or series of events. The trauma often involves a death or serious injury. The signs and symptoms of ASD and PTSD are similar. Early recognition and treatment of ASD, such as through Critical Incident Stress management, could help the possibility of ASD developing into PTSD.
- **Psychotic disorders** – psychotic disorders cause a person to lose some touch with reality, resulting in disturbance in thinking, emotions and behaviours. Psychotic disorders include schizophrenia, severe depression, bipolar disorder and drug withdrawal or intoxication.
- **Substance disorders** – the term "substance" covers numerous types of legal (prescription and non-prescription) and illegal substances. The use of a substance does not imply that the person has a problem. However, prolonged use of a substance, despite negative physical, mental, social, legal or financial consequences indicates that there may be a substance use problem (see Problematic substance use).
- **Suicide** – 90% of suicide victims have a diagnosable psychiatric illness, most commonly a mood disorder or psychotic disorder. Early recognition of these disorders and intervention may save a person's life.

Management of mental health emergencies

If you, or someone you know or encounter, is experiencing a mental health emergency get help.

If the situation is not immediately critical, the following options are available:

- Recommend that the person contact their family doctor or a psychiatrist.
- Recommend that the person contact their employer's employee and family assistance program (if available).
- Contact a provincial mental health helpline for information and referrals to counselling services.
- If the situation is critical:
- Stay with the person in crisis, if possible, and call or have someone else call 911 or EMS. Ensure that the person calling knows the address (and a specific location if the facility is large), a description of what is happening (especially if any violence is involved), and a callback number. Ask someone to meet the ambulance and guide them to your location.
- Call the Canada Suicide Prevention Service toll free 1-833-456-4566. For Quebec residents, call toll free 1-866-APPELLE (1-866-277-3553). Those services are available in English and French, 24/7.

A supportive patrol or work environment can reduce the onset, severity and duration of mental health problems.

Decompression illness

Decompression illness is a term used to describe illness that results from a reduction in the ambient pressure surrounding a body. A good example is what happens to a body that is surfacing after a dive. Decompression illness affects scuba divers, aviators and compressed gas workers. The main risk factor for decompression illness is a reduction in ambient pressure, but other risk factors are deep/long dives, cold water, hard exercise at depth and rapid ascents. Decompression illness encompasses decompression sickness (DCS) and arterial gas embolism (AGE).

DCS, also called 'the bends', is the result of inadequate decompression following exposure to increased pressure. During a dive, the body tissues absorb nitrogen from the breathing gas in proportion to the surrounding pressure. If the diver remains at pressure the gas presents no problem. If the pressure is reduced too quickly, however, the nitrogen comes out of solution and forms bubbles in the tissues and bloodstream. In some cases, the disease is mild and not an immediate threat. In other cases, serious injury does occur; when this happens, the quicker treatment begins the better the chance for a full recovery. Signs and symptoms usually appear within 15 minutes to 12 hours after surfacing, but in severe cases may appear before surfacing or immediately afterwards. Delayed occurrence is rare but does occur, especially if air travel follows diving.

AGE is the more serious form of decompression illness and results from bubbles entering the lung circulation, travelling through the arteries and causing tissue damage at a distance by blocking blood flow at the small vessel level. AGE can occur if the diver surfaces without exhaling or ascends in a panic; however, AGE can occur even if the ascent appeared completely normal. The most dramatic presentation of AGE is the diver who surfaces unconscious and remains so, or the diver who loses consciousness within 10 minutes of surfacing. These are true medical emergencies and rapid evacuation to a treatment facility is of the utmost importance.

Decompression illness – summary of characteristics

Characteristics	Decompression sickness	Arterial gas embolism
Respiratory	Coughing up bloody, frothy sputum	Bloody froth from mouth or nose
	Shortness of breath	Cessation of breathing
LOC	Unconsciousness	Unconsciousness
		Death
Behaviour	Confusion, personality changes, bizarre behaviour	Disorientation
	Amnesia	
Balance	Dizziness, vertigo	Dizziness
Neuromuscular	Tremors and staggering	Convulsions
	Paralysis, muscle weakness	Paralysis or weakness
	Numbness, tingling and paralysis	
	Unusual fatigue	
Skin	Itching	Areas of decreased sensation
	Skin may show blotchy rash	
Pain	Pain in joints and/or muscles of the arms, legs, torso	Chest pain
Other	Difficulty urinating	Visual blurring
	Ringing in the ears	

Treatment

The treatment for decompression illness is recompression in a specialized chamber; however, the first aid treatment for DCS and AGE is the same.

Activate EMS if a person has any of the following signs and symptoms within one hour of surfacing from a dive:

- confusion
- severe dizziness
- tingling or numbness of hands or feet
- visual or speech disturbances
- difficulty walking
- signs of an altered LOC
- trouble breathing
- chest pain

- unconsciousness

After activating EMS take the following immediate steps:

- administer CPR if necessary
- administer supplemental oxygen, if available, while performing rescue breaths
- position the patient on their side in case the patient vomits
- keep the patient on oxygen at the highest concentration available, as close to 100% O_2 as possible, until EMS arrives.

Watch for symptoms if they do not appear immediately. Symptoms usually appear within six hours but may appear later. Increasing joint or torso pain or other symptoms can cause severe long-term disability. If symptoms appear in the next few hours:

- activate EMS or go to a hospital emergency room
- put the patient on 100% oxygen if available until medical help arrives
- be prepared to provide information on dive(s), symptoms and treatment already received

The patient should avoid flying, travelling to higher altitude or diving for 12 to 24 hours.

20. Pediatric first aid

Learning outcome:

Recognize, understand, and explain the treatment of pediatric patients.

Upon completion of this chapter you should be able to:

1. Identify the differences between adults and pediatric patients.
2. Understand how to effectively communicate and examine pediatric patients.
3. Differentiate between treatment protocols for adults and pediatric patients.

In this chapter:

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Pediatric first aid

Pediatric patients are different from adult patients and as such, have different needs than those of the adult patients. Pediatric patients need to be treated with special care and attention.

Children of different ages are found at ski hills, lodges and their facilities. Younger children can be found at daycares that are provided at ski hills.

It is therefore important to be able to communicate and treat all ages of children, not just those you may find on the hill.

Pediatric age groups

Pediatric age groupings are based on evidence-based research specific to pediatrics.

The pediatric population is divided into the following age categories:	
Infant	up to one year (some texts may refer to one to 18 months and is acceptable)
Toddler	one to four years
Child	five to 12 years

Anatomy and physiology of the pediatric patient

Some parts of a child's body grow and develop into their adult form by approximately eight years of age. The tongue is proportionately larger than an adult in comparison to the size of the mouth. The tongue is the most common cause of airway obstruction, especially when the neonate is supine.

Figure 20-1: Infant anatomy.

Trachea

The trachea is smaller and can become easily obstructed when there is swelling. The narrowest part of the adult airway is the vocal cords, whereas the narrowest part of the child's airway is the subglottic area at the cricoid cartilage. This gradually changes until the age of eight when the

airway becomes similar to that of the adult. The airway size can be estimated by using the diameter of the child's little finger.

It will be roughly the same size as the narrowest part of the airway. For that reason, when managing the infant's airway, the neck is slightly extended, but should never be hyperextended because it will cause an airway obstruction.

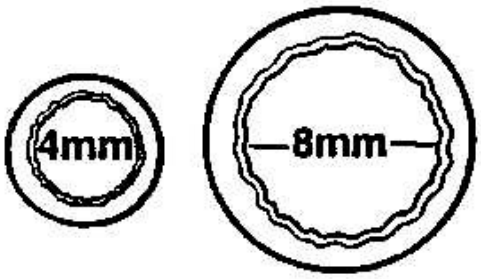

Figure 20-2: Infant versus Adult airway diameters.

Blood volume

The blood volume of a child is 80 to 90 ml/kg. When a child loses blood, the heart rate increases and the blood vessels constrict to compensate for the blood loss.

Since a child cannot sustain the increase in heart rate, eventually the blood pressure falls. The fall in blood pressure indicates that the child has lost 30 per cent or more of their blood volume and that the child is in shock.

A loss of 200 ml of blood - which is less than a cup - will cause the following percentage of volume loss:

Blood loss

CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI

Age	Total blood volume for age	Per cent of blood loss
One year	800 ml	25 per cent
Five years	1,440 ml	14 per cent
10 years	2,400 ml	8 per cent
15 years	4,000 ml	5 per cent
Adult	5,000 ml	4 per cent

Ribs

The rib cage of a child under the age of six is comprised of more cartilage than bone. A child's rib cage is more flexible than an adult's; this allows forces exerted over the chest to be dissipated over a larger area. This is the reason why children have less significant rib fractures than adults, even when greater force is applied during an injury.

Abdomen

The abdominal muscles of a child are not fully developed and therefore do not provide adequate protection for the abdominal organs. The ribcage does not protect the child's liver and spleen as

they are proportionately larger than an adults. They additionally protrude farther into the abdomen, making them more susceptible to injury.

Bones

A child's bones are softer and more flexible than that of an adult until the age of 10 to 12. This is why children tend to get greenstick fractures. Greenstick fractures refer to bones being bent and fracturing longitudinally beneath the convex surface without breaking into two separate pieces. Epiphyseal (growth) plates are located near the ends of long bones (see Chapter 14, Figure 14-1). Damage to the growth plates can affect a child's developmental growth.

Head

The head of a child is the heaviest part (20 per cent of a child's body surface area) and is often the leading part in any fall. Helmet use must be encouraged in everyone, but is critical in children.

Heart rate

The heart rate of a child is faster than an adult. When stressed or injured, the child's heart rate will increase until it cannot compensate and then will fall. When the heart rate begins to fall, especially below normal, it is an ominous sign and the child may be in critical condition.

Communication with a child

It is very traumatic to a child to sustain an injury and go through the process of assessment, treatment and transport by the ski patrol, or any other emergency medical personnel. This experience will become a part of this child's life and will most likely be remembered for a long time. Your interaction with a child patient sets the tone for all other emergency workers who may have to take care of him or her. It is important to communicate with the child, and the parents, in a calm and professional manner. Both parents and children will have concerns over their situation; they should be given as much information as possible and each procedure should be explained to them briefly before proceeding.

Remember that you are a stranger and children are not supposed to talk to strangers. Introduce yourself as a good stranger, like a policeman or a doctor. Let them know that you are there to help them and that you will explain and let them know what you're doing before attempting any procedures or using any equipment on them. This is particularly important as some pieces of equipment can appear very intimidating to a child. For example, being in a toboggan pulled by a snowmobile can be terrifying for a child. If it is possible at all, have the parent ski beside the child and keep talking to them. If the child is not stabilized on a board and there is room, you may be able to put the parent in the toboggan with a small child. Parents and children have fears about pain and worry greatly anticipating it. The fear of loss goes both directions, depending on the age of the child, as both worry about losing each other.

It is sometimes impossible to keep a parent and child together. If this is the case, let them both know exactly what is going to happen and when they will be reunited. One of the hardest situations is when a child needs to be flown out by helicopter and there is only room for the child. The parents must then get in the car and drive to the hospital. Make sure they are given specific directions and have someone else drive, if at all possible. Give the conscious child something that will remind him or her of their parents, such as a T-shirt or sweater that has been worn by the parent. This will calm them. Let the child know that they will be reunited with their parents when they get to the hospital.

Children are often literal thinkers. If you "take their blood pressure," will you give it back? The following story shows how we need to think before we speak and ask before we do things:

A little girl named Liz who was suffering from a rare and serious disease. Her only chance of recovery appeared to be a blood transfusion from her five-year old brother, who had miraculously survived the same disease and had developed the antibodies needed to combat the illness. The doctor explained the situation to her little brother, and asked the little boy if he would be willing to give his blood to his sister. He hesitated for only a moment before taking a deep breath and saying, "Yes, I'll do it if it will save her." As the transfusion progressed, he lay in bed next to his sister and smiled. Then his face grew pale and his smile faded. He looked up at the doctor and asked with a trembling voice, "Will I start to die right away?" Being young, the little boy had misunderstood the doctor; he thought he was going to have to give his sister all of his blood in order to save her.

Each age group will require a slightly different approach to communicating with them.

Toddler

- Assess from head to toe and touch the sore spots last.
- Talk gently.
- Handle gently.
- Human restraints are better than mechanical ones unless spinal stabilization is required.
- Avoid separating the parent and the child if you can.
- If you use a toy or object to calm the child, such as a stuffed bear, set the ground rules right away. So for example, if you are going to take it back, let them know the bear needs to stay at the ski hill to help all the kids who get hurt. Do not just take it back as they go out the door or EMS will have to deal with a very upset child.

Preschoolers

- Watch what you say and how you say it. Preschoolers are literal listeners and thinkers.
- Cover up the blood. This age group will focus on the blood or the most graphic injury, not necessarily the most serious one.
- Use a gentle phrase and repeat it over and over. Make sure it is one that is the truth.
- Avoid the use of statements such as "you're okay," because in their world right now, they are not okay. To them that is a lie.
- Ask them what they like to be called and use that name. Do not call them buddy or sweetie.
- Let them know it is okay to be scared and that they can cry if they need to.

School age

- Explain what happened if you can. This group often feels the injury was punishment for something and that they will be in trouble for getting hurt. Reassure them.
- Include them in all conversations and explain what you are going to do. If you are going to perform a painful procedure such as moving a fracture to put on a splint, let them know and then do it immediately. Do not let them think about it for a minute or two.
- Assessments of this age group should be head to toe the same as is done with adults.
- Address their concerns and do not undermine them.
- Respect their modesty and avoid undressing them without covering them up with a blanket or sheet.
- Allow them to have some control over their situation as long as it does not impact the outcome. For example; "which ski boot do you want me to take off first?"

Teens

- Can give their own history most of the time.
- May not wish to be assessed or treated with family or friends present.
- Still need the reassurance of a six-year-old.
- Can become hysterical.
- Respect their modesty.
- Do not undermine their concerns.

- Be patient and gentle.

Principles for effective examination

- Be caring and gentle.
- Establish a rapport with the child and the parents.
- Avoid the use of medical terminology - talk to them and with them.
- Remain calm and confident.
- Make eye contact as appropriate.
- Get at a child's level.
- Try to give the child some control.
- Never lie to them.
- Instil positive thoughts.
- Describe in their words what they may feel.
- Do as much of your assessment as you can without touching. If you do touch, do so purposefully.

Parental reaction to an injury of their child

The parents of a child who is injured may react with shock, denial, grief, guilt, rage or hysteria. All of these reactions are normal for someone in this situation. Acknowledge their feelings and reassure them that they are okay to feel this way. Do not become angry at them even if they are mad at you. They are in a situation that is out of their control and this can make people very upset. Redirect a parent who is upset but consolable into an activity that will help the child such as holding their hand or telling a story to them. An extremely agitated parent may need to calm down before helping as they may upset the child even more.

Assessment of a child

Rapid cardiopulmonary assessment

Airway

Is it patent or not. If there is fluid in the airway (gurgling) turn them on their side to drain or suction it out.

Breathing

What is the rate? A very high rate may be caused by hypoxia or the body's need for more oxygen. This could be caused by an illness or by fluid/blood loss. A decreased respiratory rate most likely means the child is getting tired. This is a flag for you to be ready to support the child's breathing by artificial ventilation.

Is the child using abnormal respiratory mechanics such as grunting to keep the alveoli open between breaths, nasal flaring or any abnormal movements such as head bobbing to help move air in and out of their lungs? What is the skin colour? Are there abnormal sounds when they breathe such as wheezing or whistles?

Circulation

What is the heart rate? What are the pulses like and how do the distal (farthest from the heart - radial) pulses compare to the central (closer to the heart - carotid) ones? What is the skin

temperature once you have them in a warm environment? Does it appear that the child is reacting normally for the age group? If a child just lays there and allows you to assess them with no fuss and only a blank stare, this may be an indication of the decreased blood flow to the brain.

Pediatric BTLS (basic trauma life support) primary assessment

Scene survey

- safety, mechanism
- number of patients
- patient's reaction

General appearance

- movement
- skin colour
- major bleeding
- angulated fractures

Level of consciousness

- recognizes parents.
- surroundings
- presence of ski patrol

Airway and SMR

- airway open and clear
- Manual SMR

Critical interventions

- modified jaw thrust
- OPA
- suction

Breathing

- look
- listen
- feel
- rate and quality

Critical interventions

- oxygen
- BVM

Neck

- observe for trauma

- observe work of breathing (retractions)
- palpate for any trauma

Chest

- observe for trauma.
- observe work of breathing (nasal flaring, retractions, grunting)
- observe chest symmetry.
- Auscultate if trained
- palpate for trauma

Circulation

- compare central and distal pulses
- rate and quality
- capillary refill
- skin condition
- stop critical bleeding

Critical transport decisions

- unstable airway
- obvious respiratory problems
- shock
- altered mental status

Packaging and rapid transport

Critical Interventions

- while preparing to transport, continue assessment

Abdomen

- observe for trauma
- palpate (tenderness, rigidity)

Pelvis

- observe for trauma
- palpate for trauma

Extremities

- observe any trauma
- palpate for any trauma
- assess motor, power and sensation

Back

(Considered part of primary assessment, checked after log roll)

- look for trauma
- palpate for trauma

Normal vital signs

See Breathing rate/respirations and Pulse in Chapter 4.

Pediatric spinal care

The spinal stabilization devices that are designed for adults often do not fit a child. Many spider straps do not tighten small enough to secure a four-year-old. Check your equipment by using it on practice cases with children of different ages. There are many ways to stabilize a child on the adult backboard but the following method allows you to roll the child without movement if the child needs to vomit. Remove helmets prior to immobilizing the child.

- Place a properly sized rigid cervical collar, if determined it is necessary. If a correct size is not available, move to the next step.
- Place a small pad such as a folded towel on the board that will pad from the child's shoulder to hips. This is done if the depth of the patient's head is greater than that of the torso. This will keep the spine aligned.
- Log roll the child onto the board and onto the padding if needed. Assess the back for trauma as you move them.
- Align the child along one side of the board.
- Pad the other side of the board with blanket rolls to take up the slack when you roll the patient.
- Cross the straps over the chest and pelvis, securing the body firmly.
- Secure the head with blanket rolls or blocks and tape in place.
- If you are using a child-sized board, you should place the child in the centre of the board with padding under the shoulder to hips if required. Many pediatric boards are molded to fit the child without any padding.

21. Transporting patients

Learning outcome:

Understand and be able to effectively transport a patient.

Upon completion of this chapter you should be able to:

1. Identify the different methods of transporting a patient.
2. Demonstrate the identified methods of transportation.
3. Recognize the appropriate transportation method based on the patient, the injury and the situation.

In this chapter:

Transporting patients 349
- Action prior to moving a patient 349
- Lifting techniques 349
- Human crutch 349
- Fore-and-aft carry 350
- Two-handed seat 351
- Three-handed seat 352
- Four-handed seat 353
- Chair carry 354
- Drag carry 355
- Cradle carry 356

Transporting a patient by toboggan 356
- Loading the patient into the toboggan 356
- Transfer patient on a backboard from a toboggan to a bed 356
- Transfer from toboggan to car 357
- Transporting a patient by stretcher 357

Out of area transportation to medical aid 358
- Conclusion 358

Transporting patients

The purpose of transporting the injured is to remove the patient from any further danger and get them to a proper medical aid facility.

Action prior to moving a patient

The most urgent priority in any emergency situation is control. You are a member of the Canadian Ski Patrol, tasked with first aid: Take command of the situation.

Before moving the patient, consider the following:

- the best method of transportation relative to the injuries
- available material, either manufactured or improvised
- assistance from bystanders
- the weight of the patient
- the route and the vehicle to be used
- reception arrangements at home or the hospital

In certain circumstances, it may be necessary to move a seriously injured patient before injuries can be determined and treated. Such circumstances include drowning, electrical contact, cave-ins, fire, falling objects and gas. A general rule of utmost importance is to avoid danger to yourself and others.

Lifting techniques

Before lifting a patient, explain what you will be doing and bear in mind the following:

- Always keep your back straight and lift with the legs when lifting anything heavy.
- When a change of direction must be made, turn your feet rather than rotating your back.
- Keep heavy loads as close to the vertical axis of the body as possible.

Human crutch

The human crutch is useful mainly in sports where there is a slight injury to one of the patient's lower extremities and the patient is conscious.

1. Stand on the injured side of the patient.
2. Place your arm around their waist, grasping clothing on their uninjured side.
3. Have the patient pass their arm around your neck. Grasp their wrist firmly with your free hand.
4. Instruct the patient to use your body as a crutch.
5. Step off together, with the inside feet.

This same method can be used with a patroller on each side of the patient.

Fore-and-aft carry

The fore-and-aft carry can be used to move a supine patient from the ground onto a bed or a stretcher when the patient is unable to assist you.

1. Two patrollers assist the patient to a sitting position. Do not pull on the arms.
2. The patroller at the head reaches under the patient's armpits and grasps the patient's opposite wrists holding the patient's arms to their chest.
3. The patroller at the head then moves the patient's upper body tightly to their chest keeping the patient's back straight.
4. Facing the direction of the move, the second patroller squats at the side of the patient's legs and takes the patient's legs at the knees.
5. Simultaneously, the patrollers lift the patient to the appropriate surface.

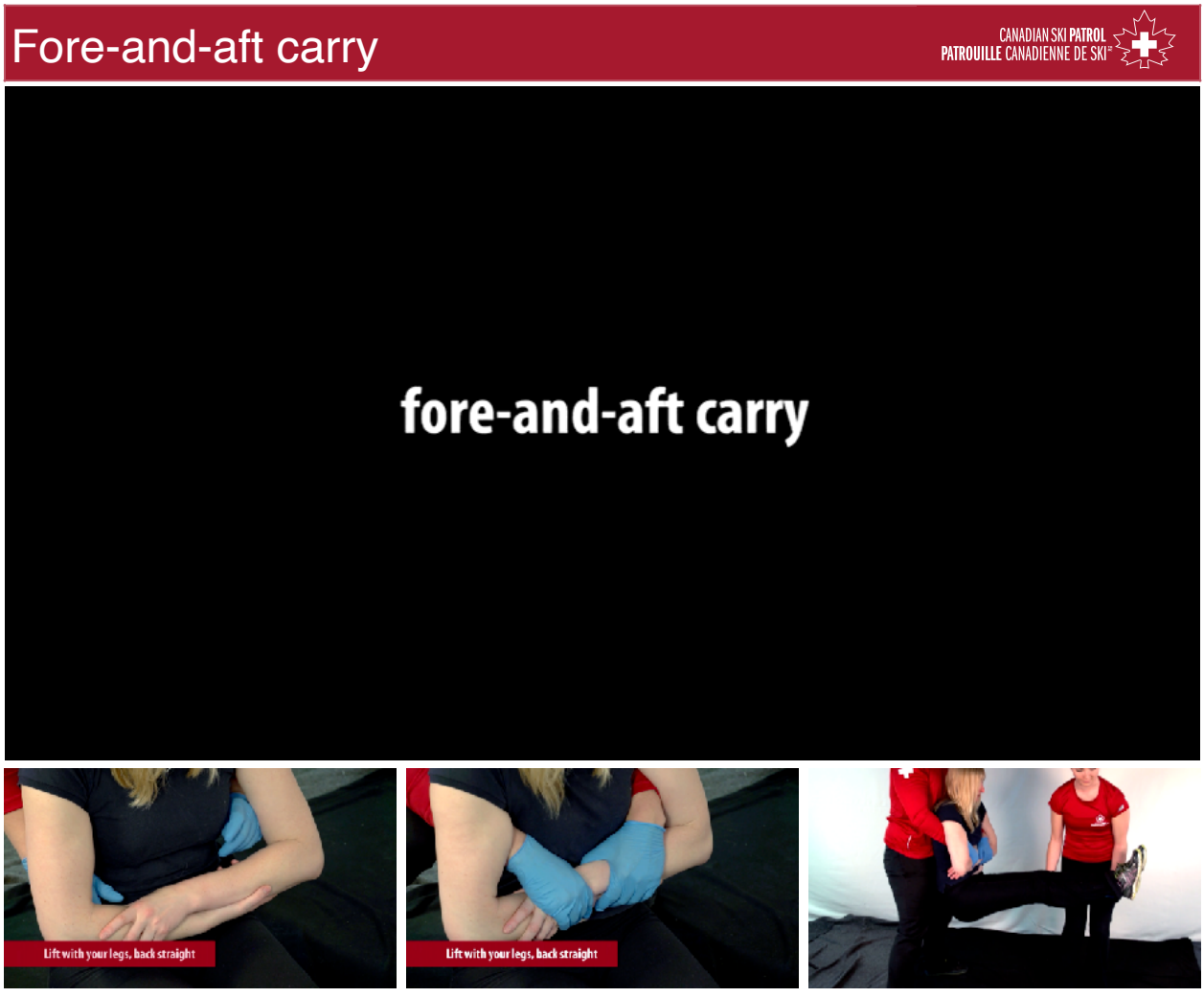

Figure 21-1: Fore and aft carry.

Two-handed seat

Use the two-handed seat with patients light enough to be carried in this manner. For heavier patients, use the four-handed seat. (see "Four-handed seat")

1. Two patrollers kneel, each on one knee on either side of the patient, each passing one arm around the patient's back, grasping each other's clothing.
2. They now pass their free arms under the patient's thighs and form either a hook grip or wrist lock with each other.
3. The patient places their arms around the patrollers' necks.
4. The patrollers rise together on a signal from the lead patroller.

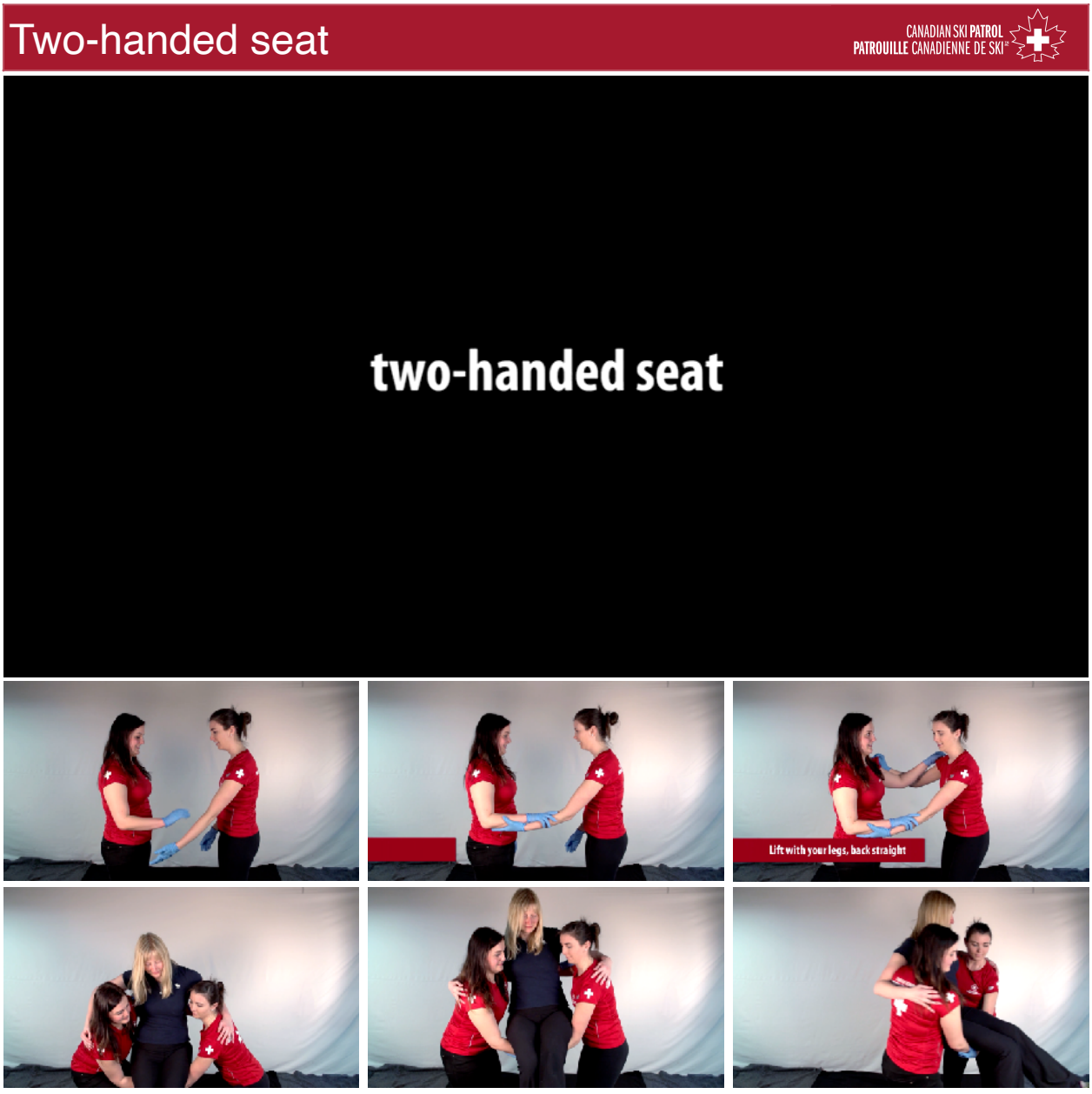

Figure 21-2: Two-handed seat.

Three-handed seat

Use the three-hand seat so one hand is free to support an injured leg or the patient's back.

1. The patrollers kneel, each on one knee on either side of the patient.
2. The patroller on the side of the injured leg keeps one hand free (left hand for left leg, right hand for right leg).
3. The other patroller grasps his own wrist as shown above.
4. Each patroller then grasps the other's free wrist.
5. The patient places their arms around the patrollers' necks and raises themselves slightly so they can place their three-hand seat in position.
6. While one patroller's hand supports the injured leg, both rise on a given signal.

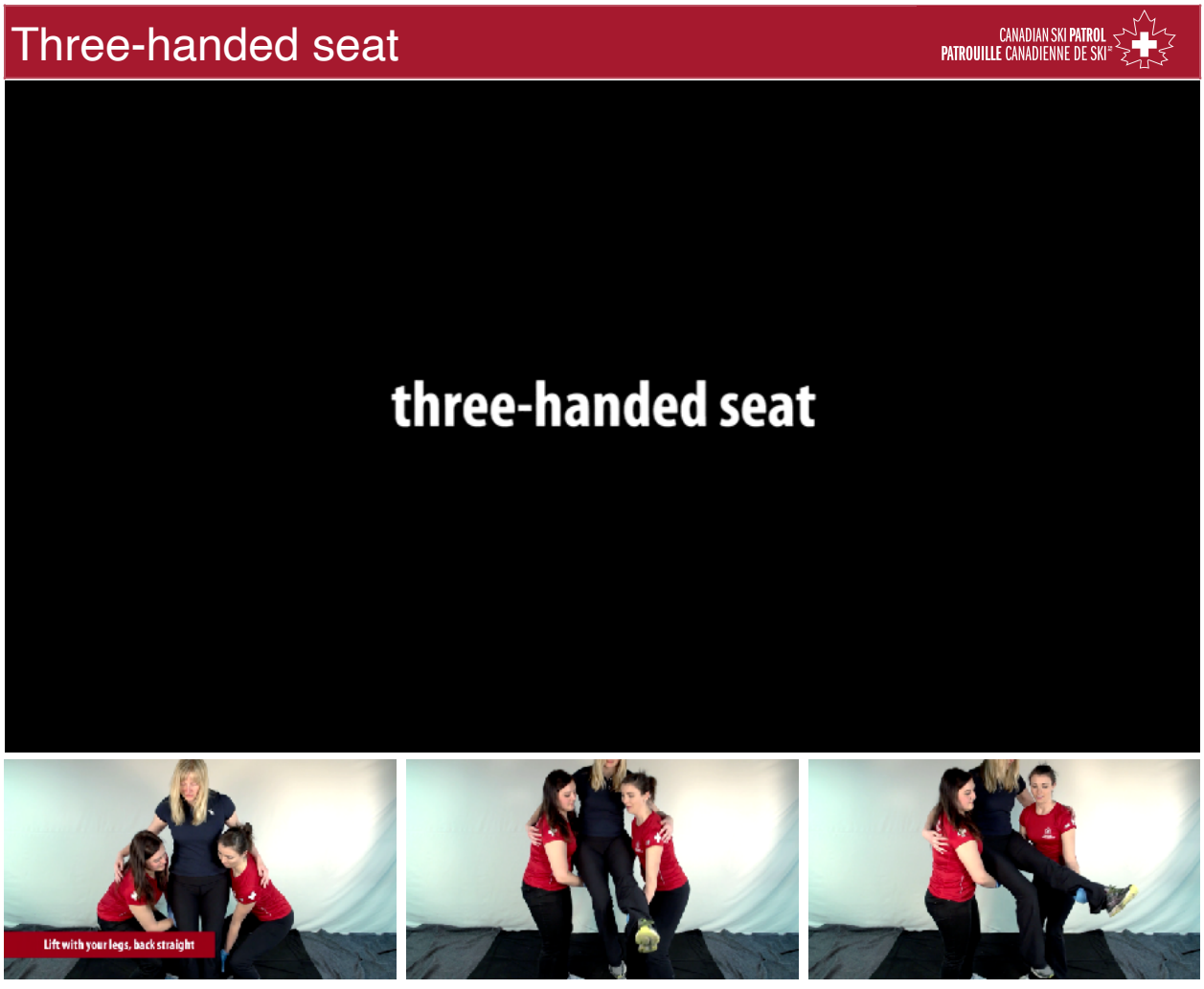

Figure 21-3: Three handed seat.

Four-handed seat

Use the four-handed seat as a replacement for the two-handed seat for a heavy patient who is able to use his arms.

1. The two patrollers kneel, each on one knee on either side of the patient and each grasps their own right wrist.
2. The patrollers now grasp each other's free wrist.
3. The patient places their arms around the patrollers' necks and raises themselves slightly so the patrollers can place their four-handed seat in position.
4. The patrollers rise together on a signal from the lead patroller.

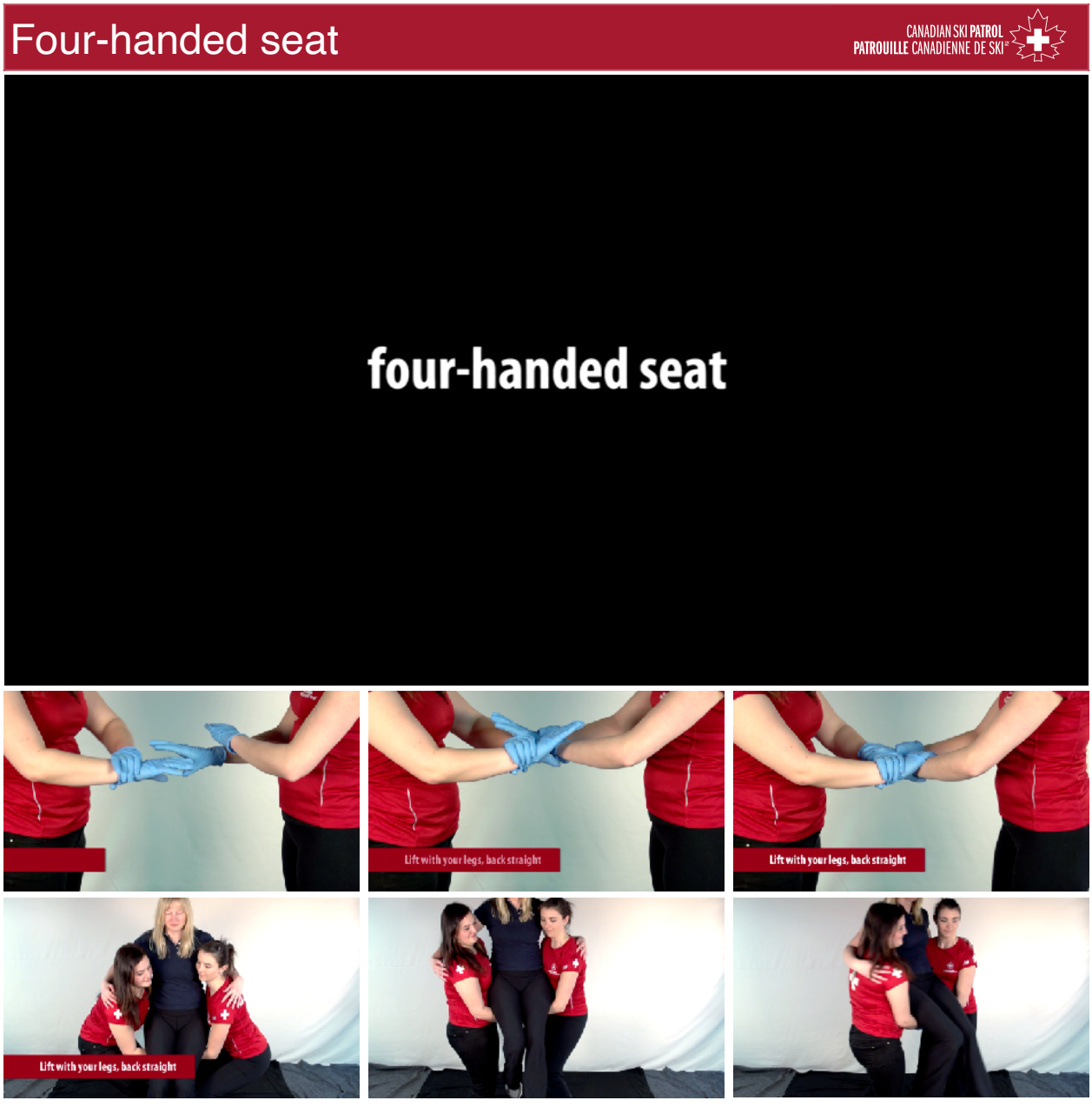
Four-handed seat
CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI
four-handed seat
Lift with your legs, back straight
Lift with your legs, back straight
Lift with your legs, back straight
Lift with your legs, back straight

Figure 21-4: Four handed seat.

Chair carry

The chair carry is used by two patrollers to carry a conscious patient down narrow stairs and passages.

1. The patient should be secured to the chair.
2. One patroller stands behind a chair and tilts it well back, resting the chair against their thighs. At the same time they extend their foot to the rear to brace themselves.
3. The second patroller stands between the patient's knees, facing the patient, then stoops and extends one leg behind him for support and balance.
4. Keeping the back and elbows straight, the patroller grasps the front legs of the chair around the patient's legs.
5. The patrollers rise together on a signal from the lead patroller.

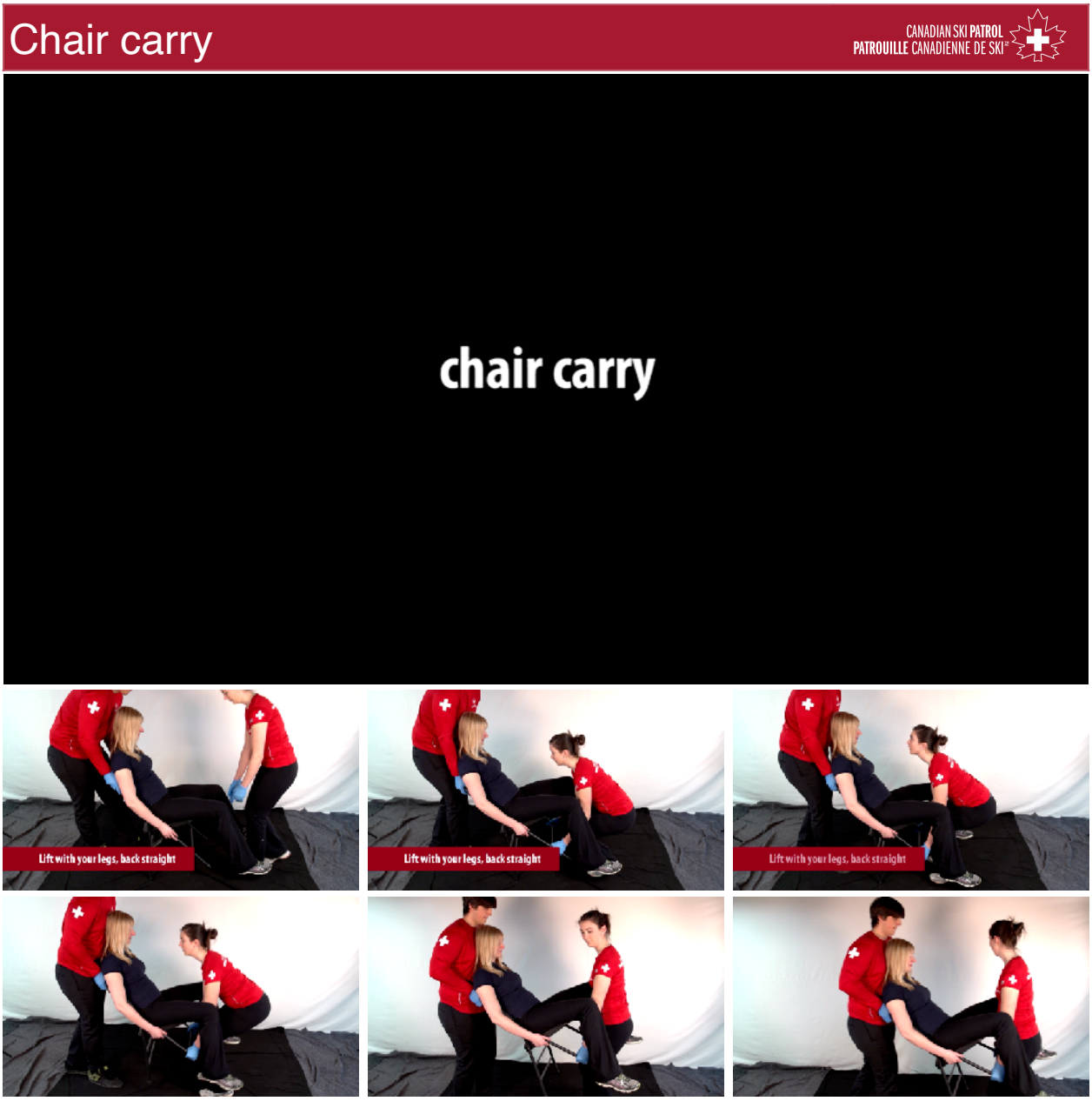
Chair carry
CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI
chair carry
Lift with your legs, back straight
Lift with your legs, back straight
Lift with your legs, back straight

Figure 21-5: Chair carry.

Drag carry

The drag carry is used to move a patient along the ground by one patrollers when that patient is unresponsive due to fire or gas. This keeps the patroller and patient low where the air is freshest. It is also used in confined spaces such as tunnels where the patroller cannot stand up.

1. With the patient supine, the patroller ties the wrists together in front of the body.
2. The patroller straddles the patient and places their head through the patient's arms.
3. The patroller then raises the patient's head and shoulders slightly with their neck.
4. The patroller crawls on the hands and knees, dragging the patient.

When descending stairs or, in case of a sudden drop, reverse the position and crawl backwards, supporting the patient's head.

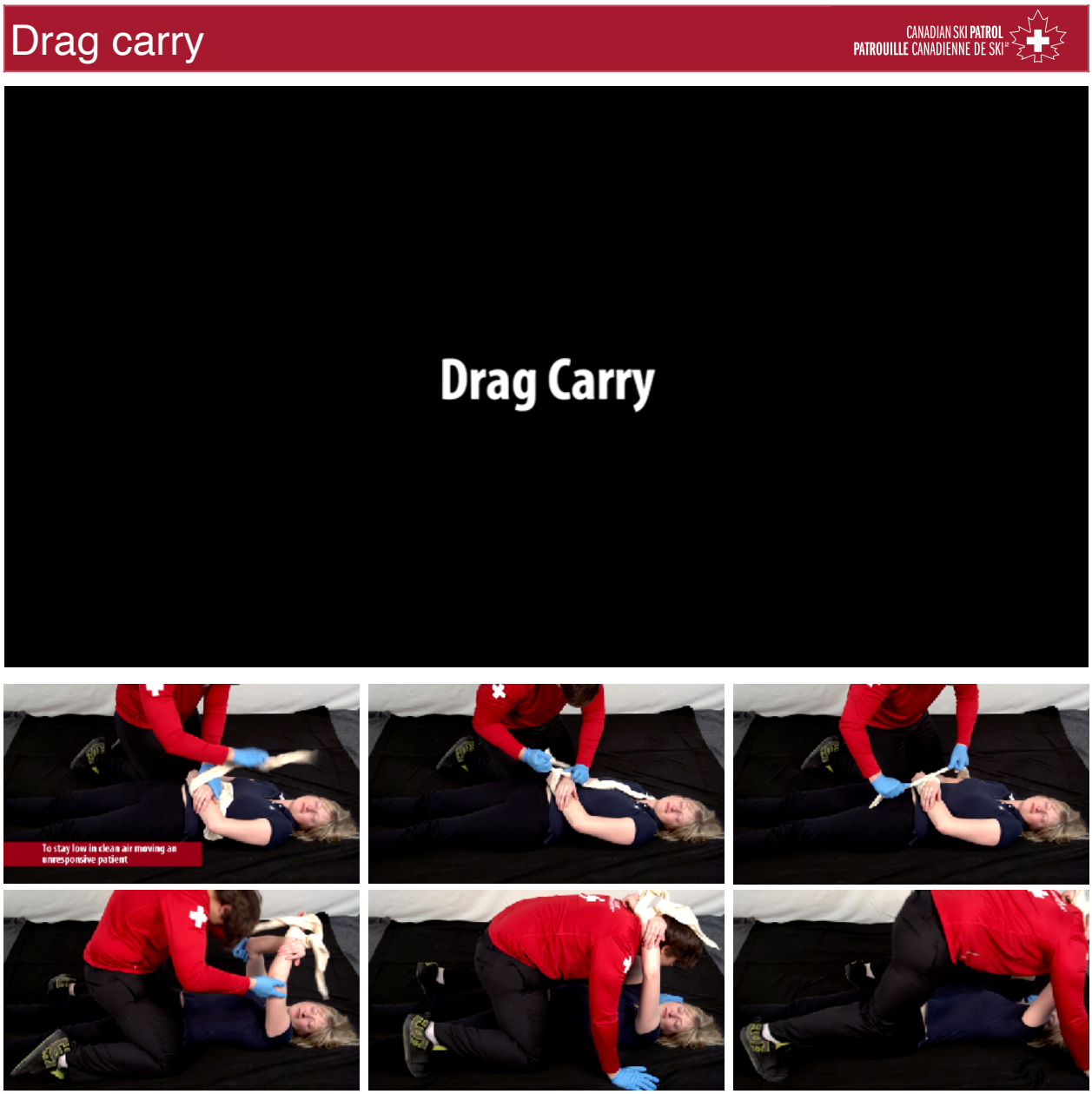
Drag carry
CANADIAN SKI PATROL
PATROUILLE CANADIENNE DE SKI
Drag Carry
To stay low in clean air moving an unresponsive patient

Figure 21-6: Drag carry.

Cradle carry

The cradle carry can be used to move a responsive or unresponsive lighter patient or a child by yourself. Do not use this method if there are neck or spinal injuries.

Raise the patient to a standing position. Place one arm around the patient's back with your hand under their arm. Place your other arm under the patient's knees and lift. If the patient is conscious have them place their arm over your shoulder.

Transporting a patient by toboggan

There are two steps to transporting a patient by toboggan:

1. loading the patient into the toboggan
2. transferring the patient from a toboggan to a bed or a car

Loading the patient into the toboggan

1. Perform any necessary splinting and other first aid.
2. Position the patient across the hill or trail.
3. Bring the toboggan to a position across the hill or trail, just above or below the patient. The position below the patient is preferred as gravity will assist with the loading.
4. Place a blanket in the toboggan for warmth before loading the patient.
5. If there is no spinal injury, pad under the head for comfort (e.g. sweaters, blankets). First aid kits should not be used as padding as it would make it unavailable to the patroller if needed.
6. Fold the flaps of the blanket over the patient.
7. Fold the flaps of the toboggan cover in place.
8. Strap the patient in.
9. Cover the patient's face if weather or snow conditions are such that it needs protection. The only exception to this is if there is a priority condition that necessitates maintaining the face uncovered. This action requires constant verbal monitoring of the patient's condition.
10. The position of the patient in the toboggan is important. In reaching a final decision about loading direction consider the type and location of injury as well as patient comfort. As an example; if vomiting is a concern, tilt the patient and the board to either side to assist with the fluid drainage.
    - Since vomiting may occur, be vigilant for the onset and be prepared to perform airway management.
    - For Nordic situations, the patient is generally transported with their head away from the handles when pulled by a snowmobile and towards the handles when pulled by a skier.

Do not attempt to load a patient into a toboggan who is not across the fall line. This is especially important on steep terrain. Having the toboggan positioned below the patient makes it easier to load the patient into the toboggan.

Transfer patient on a backboard from a toboggan to a bed

1. If the patient is on a backboard, ensure the patient is firmly tied down.
2. With one patroller at the head end and a second at the foot end of the backboard, lift the backboard, maintaining a straight back.
3. Move sideways to the bed and move the backboard onto the bed.

4. If the patient is heavy, use two more patrollers to help.

Transfer from toboggan to car

1. When loading a patient into a vehicle, place them in the back seat, if possible.
    - If they have broken their lower leg and a short splint (wire mesh, board or cardboard) was applied, the injured leg should be toward the back of the rear seat to give added comfort when traveling.
    - To accomplish this, load a patient with an injured right leg from the passenger side of the car, and the driver's side for the left leg.
2. Open the two back doors of the car. Bring the head of the patient toward the inside of the open door, approaching from the rear of the car. They will now be parallel to the car in a position beyond the swing of the door.
3. Swing the handle of the toboggan into a running position.
4. Two patrollers prepare to lift the patient at the shoulders.
5. The patient places their arms around the patrollers' necks and shoulders, each of whom places one arm behind the patient and the other hand under their thighs.
6. One patroller holds the injured leg, making sure that the splint is well-supported on each side of the fractured area.
7. The two patrollers at the patient's shoulders back toward the open car door. A third patroller enters the car and grasps the patient under both arms, taking over support from the two patrollers outside. They then ease the patient backwards onto the car seat.
    - If a third patroller is not available to help, one of the two patrollers enters the car while their partner continues supporting the patient.
    - The patroller inside then takes over the patient's support and eases them backwards onto the car seat.
    - Be sure the leading edge of the splint does not catch on upholstery, or the edge of the door.
    - Care should be taken when the doors are closed that the arm rest does not push against the patient's back or against the broken leg.
8. Once the patient is in position, slightly elevate the injured limb.

Transporting a patient by stretcher

There are two steps to transporting a patient by stretcher:

- securing the stretcher
- loading it

Securing the stretcher

1. Straighten the hinged transverse bars on the stretcher and lock them in position.
2. The leader should test the stretcher personally, making sure it will support body weight.

Loading the stretcher

At least four patrollers are required to load a patient onto a stretcher. One patroller will be in command. The procedure is the same as for handling a spinal injury, but without axial stabilization at the head and feet.

1. After the patient is secured on the stretcher, lift the stretcher evenly, using two or more patrollers as the leader directs.
2. The patrollers should walk out of step with one another to prevent jarring the patient.

Out of area transportation to medical aid

Selecting the most appropriate method of transporting a patient to further medical aid is determined by:

- the type of emergency encountered
- the condition of the patient
- the distance from medical facilities

In many cases the patient may be transported by private vehicle, particularly for non-life-threatening injuries.

Some injuries are not life threatening but still require immediate transport, for example fractures and dislocations with compromised distal circulation. These are best transported by ambulance.

An ambulance is required for all life-threatening injuries. In the most serious life-threatening cases where there is a long distance or it would take a long time to reach the medical facility, an air ambulance may be appropriate, if available.

It is an area management responsibility to ensure that there are safe patient loading zones for pick up by private vehicles and ambulances. Area management is also responsible for designating clear and safe landing zones for helicopter evacuations. The locations of these zones and any associated hazards and their mitigations will be provided by the local area training programs.

Conclusion

Avoid unnecessary movement of a patient. All movements should be slow and gentle. The patient should be transported in the position most appropriate to their injuries.

Unless this is a Load and Go situation (See “Load and Go"), do not attempt transportation until all injuries are properly cared for and adequate personnel are available to help.

If a spinal injury is suspected, stabilize the patient on a backboard. Whenever the patient is being moved, apply axial stabilization at the head and feet without twisting or bending the spine. Transport them securely tied to a backboard.

Move the toboggan or stretcher to the patient, rather than the patient to toboggan or stretcher.

Never step into or over the toboggan when loading a patient.

22. Persons with disabilities

Learning outcome:

Assess injured patients with disabilities using a whole person approach understanding different types of intellectual and physical disabilities and the management of specific conditions

Upon completion of this chapter you should be able to:

1. Assess injured persons with disabilities using a whole person approach.
2. Define the terms disability, impairment, handicap, adaptive

In this chapter:

Whole-person approach ____ 360
- Definitions ____ 361
- Rating the disability ____ 361

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Physical disabilities ____ 362
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Primary and secondary assessments ____ 364
Management and treatment of specific conditions ____ 364
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Whole-person approach

With the increased popularity of adaptive sports, patrollers may face unique challenges when assessing, treating and transporting persons with physical or intellectual disabilities. Successful primary and secondary assessments will depend on the patroller's ability to identify certain conditions and communicate effectively with the patient.

There are few age limits for persons with disabilities. Children, adults and seniors may participate in a variety of adaptive sports. Restrictions are generally more related to equipment cost and opportunity rather than to the disability itself. Surprisingly, the risk of further injury is no greater for a disabled person than for an able-bodied one. The physical consequences of inactivity for persons with disabilities include reduced cardiovascular fitness, osteoporosis, obesity, and impaired circulation.

Treating a person with an intellectual disability may involve more social and psychological skills, and draw heavily on nearby resources, such as a parent, friend coach, or service animal. Once communication with the patient has been established, assessment and care of basic injuries will be similar to other patients.

A patient's sensitivity to words needs to be taken into consideration. For example, instead of saying "see you later" to a person with visual impairment, try " I will check in on you later".

Most people will have a way that they like to be assisted and should be asked for their preference whenever possible. As recommended by the Active Living Alliance for Canadians with a Disability (www.ala.ca), the following terms are suggested to describe persons with a disability:

Instead of	Try
Disabled, handicapped, crippled	Person (s) with a disability
Crippled by afflicted with, suffering from, victim of, deformed	Person who has ... or, Person with
Lame	Person who is mobility impaired
Confined, bound restricted to or dependent on a wheelchair	Person who uses a wheelchair
Deaf, dumb, deaf mute, hearing impaired	Person who is deaf, hard of hearing
Retarded, mentally retarded	Person with a cognitive or developmental disability
Spastic (as a noun)	Person with Cerebral Palsy
Physically challenged	Person with a physical disability
Mental patient, mentally ill, mental, insane	Person with a mental illness, Person who has schizophrenia Person who has...
Learning disabled, learning difficulty	Person with a learning disability
Visually impaired (as a collective noun	Persons who are visually impaired, blind.

Definitions

A disability includes any physical or intellectual condition that hinders normal functions or daily activities. Persons with disabilities, whether inherited though genetics or acquired through trauma, prefer the term disability to handicap. The word impairment has a broader definition. This can be a loss of a physical, physiological, or psychological ability and/or the inability to perform daily tasks. A person may have impairment but not a disability. For example, a person with an amputation above the knee (impairment) may not have any problems reading, preparing meals, or driving a vehicle (disability). The person is able to wear a prosthetic, fit into alpine gear, and load the chairlift without any assistance. His impairment is not restrictive; it is adaptive.

The difference in the terms, although subtle, seems to indicate the level of assistance the person may require to achieve certain tasks. This can reveal his level of independence. If a person requires an aide or a guide in order to participate in an activity, he may have both a disability and an impairment (example: cognitive disability and a physical deformity).

An adaptive participant describes any person with an impairment or disability who is active in sports. The equipment that is used is called adaptive equipment. It is highly specialized, custom built, and very expensive.

Rating the disability

The rating system for persons with physical disabilities who compete in sports is based on a mix of diagnosed injuries and functional assessments. This method attempts to promote ability rather than dwell on the disability. Ratings for intellectual disabilities are more broadly based on gender, age, medical history, medications, and ability. In competition, knowing the rating for participants may be useful. If the person is injured and unable to speak for himself, this information, coupled with their choice of adaptive equipment (example: alpine sit-ski), can be as important as a medic alert bracelet.

Intellectual disabilities

Intellectual disabilities include many conditions ranging from traumatic brain injury and stroke, to learning disorders, autism spectrum disorders (ASD), and genetic or environmental factors. Traumatic brain injury (TBI), or intracranial injury can produce a host of physical, cognitive, social, emotional, and behavioural effects. Concussion (single or multiple), can produce temporary impairments to more permanent ones. Subdural and epidural hematomas are also included in this group and are covered in the manual (see Intracranial bleeding in Chapter 10).

A stroke may produce permanent damage and impairment (see Stroke in Chapter 16).

Learning disorders make up two streams: attention deficit disorder (ADD) and dyslexia. Those with ADD may present with a short attention span, impulsive behaviour, restlessness, hyperactivity and inability to focus on, or absorb, new information. With dyslexia, individuals have difficulty processing new information, which may hinder their success in learning a new skill. These conditions are generally not related to below-average intelligence, but may make communication with patrollers more difficult. These persons, if in distress, may not be able to help themselves follow directions given by patrollers.

The autism spectrum disorders (ASD) include a range of neurodevelopmental mental disorders, such as autism and Asperger syndrome (also known as Asperger's). These persons often have learning, behavioural, and language difficulties, which can make communication difficult. Many people with ASD do not exhibit outward signs of their disability until they are a difficult situation. Reactions to stress may include repetitive movements, isolating behaviours, aggression or seizures. People with ASD may refuse care, or if left by themselves for a few minutes, wander

away from the very people who are trying to help them. They are particularly attracted to water (rivers, lakes and pools), with a result that drowning is a leading cause of death.

People with Asperger's are intelligent with facts and figures, but lack empathy and may have poor social skills. These individuals will readily follow instructions from a figure of authority, but may behave in impulsive and unpredictable ways. They should not be left alone until the first aid situation has been resolved, and they are 'handed off' to a responsible friend or family member.

Treat people with intellectual disabilities as you would any other patient. If the injured person has an aide or caregiver, be sure to include them in any communication. In addition to physical injuries, persons with intellectual disabilities may present with symptoms that may include anxiety, hyperactivity, and poor decision-making, and it may take more time than usual to gain their trust and cooperation.

Patrollers should remain as calm and be as understanding as possible, because persons with intellectual disabilities are easily distracted.

People with Down syndrome (DS) have a wide range of physical and intellectual disabilities. People with Down syndrome share common facial features, have a short stature, and a pleasant disposition, but differ in their intellectual capabilities.

A person with Down syndrome can be very competitive and less likely to complain about injuries that may hinder their ability to participate in the event. They are also at an increased risk for musculoskeletal injuries because the ligaments that stabilize vertebrae are “lax”.

Physical disabilities

Amputees

Amputees use a wide variety of adaptive equipment and prosthetics. Amputations can be congenital, traumatic, or surgical (due to osteogenic sarcoma (cancer), diabetes, toxicity, frostbite, chronic infections, and flesh-eating disease). Some people have more than one amputation, and there are partial losses, which affect to what degree they are able to participate.

Many people with an upper extremity amputation do well in standing snow sports. Those with a lower limb amputation can be fitted with a prosthetic, which allows for standing activities. In double lower leg amputations above the knee, most people prefer to Nordic or alpine sit ski.

Spinal cord injury

Spinal cord injury (SCI) may be acquired, or may be due to congenital conditions, as in spina bifida and cerebral palsy.

Persons with permanent loss of use or sensation in the lower extremities have paraplegia, whereas those with loss in all extremities have quadriplegia. The nerve damage in SCI affects sensory perception and motor control at or below the level of the injury. Above the injury site, the person may have normal pulse, motor control, sensation (see Pulse, motor response and sensation in Chapter 4) and muscular strength. Below the injury site, depending on the level of injury, there may a partial or total absence of PMS. Most persons with SCI know if their lesion is partial or complete. If the injury is complete, their bodies' autonomic functions can be compromised. For example, a spinal lesion between T1 and T4 may limit heart rate to a maximum of 110 and 130 beats per minute. If the person is in distress this may lead to insufficient tissue perfusion and may result in hypoxia.

Ostomies

A variety of medical adjuncts have been designed to help alleviate autonomic dysfunction in people with SCI. These include bladder catheters or urostomy port tubes, and exterior urine collection bags which empty into exterior urine collection bags, and ileostomy and colostomy bags for the collection of feces. The bags are connected to the ports by pliable silicon seals. Patrollers should be cautious when assisting a person with an ostomy bag, port and seal, as pressure may cause them to kink, leak or burst.

Autonomic dysreflexia

See Autonomic dysreflexia in Chapter 16.

Cerebral palsy

Cerebral palsy (CP) is caused by a lack of oxygen to the fetal brain during childbirth. CP is not an intellectual disability. The subsequent brain injury presents as impaired voluntary motor function and coordination. The patterns of CP include spastic, athetoid, and dystonic. Spastic CP, which is the most common, has intermittent, jerky, and/or repetitive involuntary muscle contractions in one or more extremities. Athetoid CP manifests as slower involuntary contractions, whereas dystonic CP manifests as rigidity in one or more limbs. All forms of CP include impaired balance. Persons with CP are at increased risk of extremity injury from falls as they may not be able to protect themselves or recover from a loss of balance. Fractures or dislocations may increase spasticity, which makes splinting, applying traction or immobilizing an injured extremity difficult.

Because of the issues with balance, most people with spastic or athetoid CP are more likely to Nordic or alpine sit ski, even though they are capable of walking.

Spina bifida

Spina bifida (SB) is a congenital malformation in which the spinal column fails to form and close posteriorly, which exposes the spinal cord to possible injury. Individuals with SB report sensory or motor deficits in the vicinity of the lumbar region, or at the site of the malformation. Abnormal circulation of cerebrospinal fluid (CSF), may cause increased pressure in the brain and spinal cord. Some patients may have a shunt to drain excess CSF into the abdominal cavity. If this tube becomes kinked or blocked as a result of trauma, the patient may develop a severe headache and altered level of consciousness.

Multiple sclerosis

Multiple sclerosis (MS) is a progressive disease that affects both the central and peripheral nervous systems. Symptoms may include paralysis of the extremities, imbalance, fatigue, visual deficits, mood changes, and slurred speech. Persons with MS may have difficulty communicating. Persons with mild MS may be able to ski standing, however as the disease progresses, fatigue and weakness make it very difficult to switch to sit ski.

Muscular dystrophy

Muscular dystrophy (MD) is characterized by spinal curvature, weak and atrophied muscles, possibly resulting in loose joints and fatigue.

Visual and auditory deficits

Visually impaired skiers have higher rates of injury when compared to sighted skiers. Patrollers must take care to explain in detail beforehand how they plan to provide treatment.

Hearing impaired patients may slur their words, and speak in monotones; this should not be mistaken for an intellectual disability. In treating those with hearing loss, patrollers should face the patient, speak clearly and wait for an answer before asking the next question.

Primary and secondary assessments

When treating persons with disabilities, ask what a person's normal is. This will help to establish a baseline for further care. The fascinating and complex thing about a disability is that everyone is different.

Thorough collection of vital signs and a thorough secondary assessment will likely uncover some deficits. Patrollers should monitor injured persons with disabilities frequently and carefully in order to detect changes in their current condition.

Management and treatment of specific conditions

Autonomic dysreflexia

Please see Autonomic Dysreflexia in Chapter 16.

Thermoregulation

Persons with a spinal cord injury at T6 or above may have impaired temperature regulation in extremities due to a lack of sensory input, a lack of shivering response, and impaired vasoconstriction.

Patients with paralysis may have decreased circulation in the affected limb. For example, a paralyzed arm may be tied to the body with a sling for stability; legs may be tightly squeezed into a sit-ski. These restrained limbs can become very cold as the person cannot feel any sensation. The left and right pulses may not be equal, and the skin colour, moisture and temperature may differ.

Signs and symptoms of impaired thermoregulation:

- confusion
- pale and cold skin
- vital signs are not equal or bilateral
- shivering is absent
- increased spasticity
- increased risk for autonomic dysreflexia

Management

1. Recognize the condition as serious.
2. Adjust the affected limb.
3. Compare left and right extremities.
4. Re-warm the patient gently (see Frostbite and superficial frostbite in Chapter 17).

Spasticity

Spasticity can occur in any individual with a spinal cord injury or injury to the brain (congenital or acquired). The most common is spastic CP and one cause may be an irritant. In some individuals, spasticity can occur frequently and is velocity dependent. It can worsen if the person's limbs are moved rapidly. Slow and careful attention by patrollers caring for a person with this condition is very important.

Signs and symptoms

- increased muscle tone
- clonus (series of rapid muscle contractions)
- scissoring of the legs
- fixed or frozen joints

Management

1. Recognize the condition.
2. Determine and treat the stimulus.
3. Use slow and careful handling.
4. Consider padding instead of splinting.
5. Maintain position of comfort.
6. Stay calm and reassure the patient.

Pressure sores

Pressure sores can develop when skin suffers from friction or shear stress, when bony parts of the body press against a hard surface, or the sheath of a prosthetic, for long periods of time. Skin damage may also be caused by abrasions from clothing such as buttons, bulky seams, boots, objects placed in pockets, catheter connections, clamps, tight stockings, and some adaptive equipment. Blisters are a common annoyance and should not be neglected. Patrollers need to take all skin conditions seriously in order to alleviate pain and discomfort, and avoid future loss of mobility and/or infection. Even small sores should command attention.

Signs and symptoms of pressure sores:

- redness and swelling
- joint pain
- bleeding
- infection and abscess

Management of pressure sores:

1. Remove the offending object(s).
2. Protect the skin against further abrasion or irritation.
3. Pad the affected area well with sterile non-stick dressings.
4. Do not break blisters.

Fractures and dislocations

Fractures and dislocations should be treated according to the manual (see Fractures, Dislocations and Soft Tissue Injuries in Chapter 14). Stabilizing of injuries with persons with disabilities involves splinting in a position of comfort, or padding to provide structure. Do not try to splint a limb that is undergoing spastic movements, or place a deformed limb (that is the 'normal' for that patient) in a straight 'anatomical' position. If possible, patrollers should be responsive to a patient's choices. For example, if a patient wishes to sit up rather than lay in the toboggan, or be transported head uphill rather than downhill, some additional stress or discomfort may be alleviated.

In the case of lower-leg fractures with an amputated extremity, i.e., a femur fracture with an above-the-knee amputation, traction will be ineffective because patrollers cannot apply or maintain the device properly due to the shortened limb and absent foot.

Engaging with disabled skiers is rewarding. Aside from the pure enjoyment, if a patroller accompanies an adaptive skier on the lift and they do a run together, the patroller gains a closer look at the equipment and the opportunity to ask questions. Then, if a situation should occur, the patroller will know more about the skier, the equipment and their disability.

Figure 22-1: Attending to a patient in a sit-ski.

Specialized adaptive equipment

For more information on specialized adaptive equipment, refer to the Adaptive snow sports appendix of the On patrol section of the Patroller's Manual.

Transporting of adaptive equipment and prosthetics must be done with extreme care and respect. These items often cost thousands of dollars, and may be irreplaceable if damaged in transit. Keeping a patient's adaptive equipment nearby may be useful, and will help reduce anxiety. Accept any instructions given by the patient with regards to the handling of gear. (For more detailed information on adaptive equipment, see Adapter equipment chapter in the Operations Manual).

Special considerations

Many disabled persons have a service animal at the base lodge. This animal is part of the patient's support system and should be brought as close as possible. Having the animal present will go a long way to reducing the patient's stress and anxiety.

Glossary

A

ABC Method

The sequence of operations required in cardiopulmonary resuscitation. A stands for airway, B stands for breathing, and C stands for circulation.

Abdomen

The region of the body between the diaphragm and pelvis.

Abdominal cavity

The anterior body cavity that is located between the diaphragm and the bones of the pelvic ring.

Abdominal thrusts

Manual thrusts that are delivered to the midline of the abdomen, between the xiphoid process and the navel, to create pressure to help expel an airway obstruction.

Abortion

The spontaneous (miscarriage) or induced delivery of the fetus and placenta before the 28th week of pregnancy.

Abrasion

A scrape. An open wound that damages the surface of the skin without breaking all the skin layers

Abscess

A collection of pus in a sac, formed by dead tissue and accumulation of white blood cells.

Absence seizure

A type of generalized seizure which causes lapses of awareness, sometimes with staring and lasting only a few seconds. Previously identified as a petit mal seizure.

Achilles tendon

The common term for the tendon that connects the posterior leg muscle to the heel.

Acquired immune deficiency syndrome (AIDS)

See “AIDS" below.

Actual consent

Agreement by a patient to accept emergency care. This has to be a rational adult patient. This must be informed consent - see "Informed Consent" below.

Acute

To have a rapid onset. It sometimes means severe. Opposite of Chronic.

Acute myocardial infarction

A heart attack. The sudden death of the heart muscle due to oxygen starvation. Usually caused by the narrowing or blockage of one of the blood vessels (coronary arteries) supplying oxygen to the heart muscle.

Adrenalin

A hormone produced by the adrenal gland, which acts as a stimulant. Also known as epinephrine.

Aerobic

Requiring oxygen to function.

Afterbirth

The placenta, part of the umbilical cord and some tissues of the womb's lining that are delivered after the birth of the baby.

Agonal breathing

Agonal breathing may sound like gasping, grunting or noisy breathing with accessory muscle or abdominal movement. It is not normal, regular breathing and can happen when someone first goes into cardiac arrest.

AIDS

Acquired Immune Deficiency Syndrome is a fatal disease first noted in 1978 that results from infection by HIV. It spreads through direct contact with body fluids of infected individuals.

Alert

Aware, oriented to space and time, full mental faculties. An assessment of the state of consciousness.

Airway

The passage of air from the nose and mouth to the lungs.

Alveoli

The air sacs of the lung where oxygen and carbon dioxide exchange with the blood stream takes place.

Alimentary canal

The tubular passage which extends from the mouth to the anus and functions in digestion, absorption of food and elimination of residual waste.

Amnesia

The short or long term loss of memory.

Amputation

The surgical or traumatic removal of a body part. The most common usage applies to the traumatic removal of an extremity or one of its parts.

Anaphylactic shock

The most severe type of allergic reaction with severe breathing spasms and collapse of the circulatory system, which may be fatal.

Anaphylaxis

An unusual or exaggerated allergic reaction to foreign proteins or other substances.

Anatomy
The study of the body structure.

Anatomical position
The standard reference position for the body in the study of the anatomy. The body is standing erect, facing the observer. The arms are down at the sides and the palms of the hands are facing forward.

Angina pectoris
The chest pains caused by an insufficient blood supply to the heart muscle.

Angulation
The angle formed above and below a break in a bone. The fracture changes the straight line of a bone into an angle.

Anoxia
A lack of oxygen in the tissues.

Anterior
The front surface of an object.

Antiseptic
Any preparation that prevents the growth of and/or multiplication of bacteria.

Antitoxin
An antibody produced in the body which is capable of neutralizing a given toxin, bacterial, plant, or animal.

Antivenom
An antitoxin given to a person who has been poisoned by an animal or insect venom.

Aorta
The largest artery in the body, which originates from the left ventricle and supplies blood to the body.

Arterial bleeding
The loss of bright red blood from an artery. The flow may be rapid, spurting as the heart beats.

Arteriole
A minute arterial branch.

Artery
A muscular, thick-walled blood vessel which carries blood away from the heart.

Artificial respiration (AR)
The maintenance of breathing by artificial ventilation in the absence of normal spontaneous breathing.

Artificial ventilation (AV)
Any method used to force air in and out of the lungs.

Asphyxia
Suffocation caused by decreased oxygen and increased carbon dioxide in the blood.

Aspiration
To inhale materials into the lungs.

Assisted ventilation
A method of providing additional air and/or oxygen to a patient whose breathing is inadequate.

Asthma
The condition in which the bronchioles in the lungs constrict, causing a reduction of airflow and causing congestion. Air will usually enter easily, but cannot be exhaled easily.

Asymmetry
Not symmetrical; lack of correspondence of parts on opposite sides of the body.

Asystole
When the heart stops beating.

Ataxia
Inability to coordinate the muscles properly; used to describe a staggering gait.

Atherosclerosis
A form of hardening of the arteries.

Atonic seizure
A type of generalized seizure where the person suddenly loses muscle tone where the head or body goes limp. It can begin in one side of the brain (focal onset) or both sides (generalized onset).

Atrium
Either of two receiving chambers of the heart, from which blood moves to the ventricles.

Auscultate
The action of listening to sounds from the heart, lungs, or other organs, typically with a stethoscope, as a part of medical diagnosis.

Autonomic
Not subject to voluntary control.

Autonomic nervous system
Part of the nervous system which regulates cardiac, gland, and smooth muscle activity. This includes digestion and sweating. It cannot be controlled voluntarily.

Avulsion
A piece of tissue or skin that is torn loose or pulled off by injury.

B

Bag valve mask
A portable unit device consisting of a bag, a valve, and a mask used to give artificial ventilation or assisted ventilations.

Bandage
An item, such as gauze or tape, that can be used to hold a dressing in place.

Barbiturates

Class of drug that produces a calming, sedative effect.

Basic life support (BLS)

The ABC's of emergency care. Those events related to the findings of the priority assessment. (see “Basic Life Support" Chapter 6)

Battle's sign

A bluish discolouration of the area over the bone just behind the ear; may indicate a fracture to the base of the skull (basal skull fracture).

Bilateral

Pertaining to both sides of the body.

Bile

A greenish-yellow fluid secreted by the liver to aid in fat digestion.

Biological death

When lung and heart activity has stopped and brain cells die. Lethal changes usually begin to take place in the brain within 6 to 10 minutes after cardiac arrest. This process may be delayed by cold temperatures.

Bladder

A hollow organ which serves as reservoir for urine.

Blood

Fluid circulating through the heart, arteries, capillaries and veins. It carries oxygen, nutrients, hormones , etc., to the cell, and removes carbon dioxide and waste materials.

Blood pressure

Is the pressure that circulating blood exerts against the walls of the arteries.

Brachial pulse

The pulse measured by feeling the major artery of the upper arm against the humerus. This is the most reliable location to detect the pulse in infants.

Brain stem

Most inferior portion of the brain.

It is directly attached to the spinal cord.

The brain stem controls breathing, heart function, and blood pressure

Bronchiole

The small branches of the airway that carry air to and from the air sacs of the lungs.

Bronchospasm

Spasmodic contractions of the smooth muscle of the bronchi, as occurs in asthma.

Bronchi

The portions of the airway connecting the trachea to the lungs.

Bruise

A contusion, the simplest form of a closed wound. The blood flows into the tissues causing a discolouration.

Burn

An injury caused by heat, flame, electricity or radiation; or a similar injury caused by some chemicals.

C

Capillary

A microscopic blood vessel through which exchange takes place between the bloodstream and the cells.

Capillary bleeding

The slow oozing of blood from a capillary blood vessel.

Carbon dioxide

An odourless, colourless, non-combustible gas. It is a normal by-product of body metabolism, eliminated through the lungs.

Carbon monoxide

An odourless, colourless, and poisonous gas. If inhaled, it combines with the hemoglobin of the red blood cell and blocks the transport of oxygen, thus causing asphyxiation.

Cardiac arrest

When the heart stops beating.

Cardiopulmonary resuscitation (CPR)

Heart -lung resuscitation where there is an effort to both artificially restore or maintain respiration and circulation.

Cardiogenic shock

Caused by the heart failing to pump enough blood to all parts of the body.

Cardio-vascular

Pertaining to the heart and blood vessels.

Carotid artery

The large neck arteries. One is found on each side of the neck.

Carpal bones

The eight small bones of the wrist.

Cartilage

A form of connective tissue containing a tough, elastic substance, found in joints, at the developing ends of bones, and in specific areas such as the nose and ears.

Central nervous system

The brain and spinal cord.

Cerebellum

The smaller posterior portion of the brain.

It regulates body movement, posture, balance, and muscle tone.

Cerebral
Relating to the brain.

Cerebrospinal fluid
The clear, watery fluid that helps to protect the brain and the spinal cord.

Cerebrovascular accident (CVA)
The result of blockage or damage to a brain artery. Headache, confusion, paralysis (often to one side only), impaired vision, impaired speech, unequal pupil size, and many other signs and symptoms are possible (also known as stroke).

Cerebrum
The portion of the brain which controls higher functions such as voluntary control of the body, sensation, thought, reasoning, memory.

Cervical
Relating to the neck. The same word is also used to refer to the cervix, the lower portion of the uterus (womb).

Chief complaint
The problem for which a patient seeks help, in one word or a short phrase.

Chronic
Long or drawn out or recurring. Opposite of "Acute".

Chronic obstructive pulmonary disease (COPD)
A condition in which there is a progressive decline in the lung's ability to exchange oxygen and carbon dioxide. COPD includes chronic bronchitis, emphysema, and some types of chronic asthma.

Circulatory system
Consists of the heart, blood vessels, and lymph vessels.

Clammy
Moist and cold skin.

Clavicle
The collar bone.

Clinical death
The state reached when breathing and heart action cease but brain activity is still present.

Closed fracture
A simple fracture where the skin is not broken by the fractured bone ends. The fracture site is not exposed to the outside world.

Closed wound
An injury where the skin is not broken, as in the case of a bruise.

Clot
The formation composed of fibrin and the entangled blood cells that act to help stop the bleeding from a wound.

Coagulation
The change from a liquid to a thickened or solid state; formation of a clot.

Coccyx
The lowest part of the backbone, formed by four fused vertebrae (tail bone).

Codeine
A pain-dulling narcotic drug derived from opium.

Collateral
Accessory or secondary; not direct or immediate.

Collateral circulation
The circulation established to tissue whose original blood supply has been obstructed.

Colon
The large intestine.

Coma
The state of complete lack of response from which a patient cannot be aroused, even by powerful stimulation.

Comatose
Obsolete medical term referring to 'in a state of coma', meaning unresponsiveness from which a patient cannot be aroused.

Comminuted fracture
A fracture where the bone is fragmented or crushed to pieces.

Concussion
A mild state of stupor or temporary lack of response, often caused by a blow to the head.

Congenital
Any condition that exists or was acquired before or at birth.

Congestion
An abnormal accumulation of fluid within an organ.

Congestive heart failure
Failure of the ventricles to pump blood effectively, causing backup of blood or fluid into the lungs or body tissues.

Conscious
The patient is oriented, talks coherently, can answer correctly questions about name, address, location, day, and date.

Contusion
A bruise; an injury that causes a hemorrhage into or beneath the skin but does not break the skin.

Convulsion
Uncontrolled skeletal muscle spasm or a series of spasms, often violent. Commonly called "seizure" or "fit".

Coronary
A term applied to the large arteries which supply blood to the heart muscle (myocardium).

Coronary artery disease
The narrowing of one of more places in the coronary arteries brought about by atherosclerosis. Blockage may eventually occur.

Cortex
Outer part of the brain concerned with voluntary action.

Cranium
The bones encasing the brain.

Cramp
Painful involuntary contraction of a muscle.

Cranial
Pertaining to the skull.

Cravat -
A piece of cloth material that can be used to secure a dressing or splint.

Crepitus
A grating noise or the sensation felt caused by the movement of broken bone ends as they rub together.

Critical incident stress debriefing
Sessions that are held after a disaster or emergency incident to address the needs of patrollers who may have been influenced by the scene and the stress generated in providing emergency care.

Crowning
When the presenting part of the baby first bulges out of the vaginal opening.

Cyanosis
A bluish discolouration of the skin and mucous membranes due to insufficient oxygen in the blood.

D

Defibrillation
Application of an electric shock to a patient's heart in an attempt to disrupt a lethal rhythm and allow the heart to spontaneously re-establish a normal rhythm.

Dehydration
Excessive loss of water from the body or a tissue.

Depressed fracture
A fracture of the skull in which a segment is depressed. It is very important to avoid pressure on such a fracture.

Dermis
The inner (second) layer of the skin. It is the layer that is rich in blood vessels and nerves found below the epidermis.

Diabetes
A disease resulting from the inadequate production of insulin by the pancreas.

Diabetic coma
The result of inadequate insulin supply or high blood glucose levels that leads to unconsciousness, coma, and eventually death unless treated. Also know as Hyperglycemia.

Diabetic shock
The result of too high an insulin supply or low blood sugar, which if untreated will rapidly lead to a shock-like condition and death.

Diagnosis
Distinguishing one disease or injury from another; the determination of the nature of the disease or injury.

Diaphoresis
profuse perspiration.

Diaphragm
A dome shaped muscle that separates the chest cavity (thorax) from the abdominal cavity. It is the major muscle of respiration.

Diarrhea
The passing of soft or liquid stools with abnormally high frequency. Can result in Hypovolemic Shock.

Diastole
The part of the cardiac cycle during which the ventricles relax.

Diastolic pressure
Blood pressure measured when the heart is resting between beats.

Digestive system
The group of body organs that carry out digestion, digestion is the process in which food is broken down mechanically and chemically and is changed into forms that can enter the blood stream and be used by the body.

Dilation
To enlarge, having expanded in diameter.

Direct pressure
The quickest, most effective way to control most external bleeding. Pressure is applied directly over the wound site.

Dislocation
The displacement of the ends of two bones at their joint, so that the joint ends are no longer in proper contact.

Distal
Farther from a point of reference. In case of extremities, farther away from the body core.

Distension
Bulging or swelling.

Dressing
A protective covering for a wound that will aid in the stoppage of bleeding and helps to prevent contamination.

Dura mater
The outermost and toughest of the outer three membranes of the brain and spinal cord (meninges).

Duodenum
The first portion of the small intestines, connected to the stomach.

Dyspnea
Shortness of breath, difficult or laboured breathing.

E

Edema
Swelling due to the accumulation of fluids in the tissues.

Elation
A feeling of well-being "happiness", commonly exaggerated.

Emergency care
The prehospital assessment and basic care provided for the sick or injured patient. The care is started at the emergency scene and is continued through transport and transfer at the medical facility.

Emergency medical services (EMS)
A chain of services linked together to provide care for the patient at the scene, during transport to the hospital, and upon entry at the hospital.

Emergency medical technician (EMT)
A general term for the emergency personnel who provide pre-hospital care, typically from an ambulance.

Emphysema
A chronic disease of the lungs, in which the alveoli suffer major enlargement and a progressive loss of elasticity. This reduces the capability of the lungs to exchange oxygen and carbon dioxide. The patient exhibits rapid, shallow breathing and the condition frequently results in a secondary impairment of heart activity.

Endocrine
Glands which secrete their hormones into the bloodstream, such as the pituitary, thyroid and adrenal glands; also called ductless glands.

Epidermis
The outer layer of skin.

Epiglottis
A flap of cartilage and other tissues that is at the top of the voice box (larynx). It closes the airway and diverts solids and liquids down the esophagus.

Epilepsy
A chronic medical disorder characterized by attacks of unresponsiveness, with or without convulsions.

Esophagus
The food tube leading from the throat (pharynx) to the stomach.

Evisceration
Usually applies to the intestine protruding through an incision or wound.

Expiration
The action of breathing out.

Extradural
Outside the dura mater.

Extrication
Any actions that disentangle and free from entrapment.

F

Fainting
The simplest form of shock, occurring when the patient has a temporary, self-correcting loss of consciousness caused by a reduced supply of blood to the brain. Also called psychogenic shock.

Femoral artery
The main artery of the upper leg (thigh).

Femur
The thigh bone, the longest and largest bone of the body.

Fetus
The developing unborn child. It is an embryo until the third month, when it becomes a fetus until birth.

Fever
Elevated body temperature.

Fibrillation
Uncoordinated contractions of the heart muscle. The pumping action of the heart is ineffective. See "Ventricular Fibrillation".

Fibrin
Fibrous protein material that is used to produced blood clots.

Fibula
The lateral and smaller of the two bones of the lower leg.

First-degree burn
A mild partial-thickness burn, involving only the outer layer of skin.

First responder

An individual who has received training in emergency care in order to provide for the patient before EMTs arrive. The level of training allows this individual to assist EMTs at the scene.

Flaccid

Soft and flabby.

Flail chest

A loose section of the chest caused by multiple adjacent rib fractures.

Flail segment

The section of the chest wall which lies between the fractures and moves opposite to the normal chest movement.

The movement is called "paradoxical breathing".

Flexion

To increase an angle of a joint. To bend, as in bending the knee or bending at the elbow.

The opposite of extension.

Focal onset aware seizure

A focal onset aware seizure starts in one area of the brain and the person remains alert and able to interact. These seizures are brief, lasting seconds to less than 2 minutes.

Focal onset impaired awareness seizure

Focal onset awareness impaired seizures start in one area or side of the brain and the person is not aware of their surroundings during the seizure. These seizures typically last 1 to 2 minutes and may include automotisms, becoming unaware of surroundings and wandering.

Fracture

A break, crack, split or crumbling of a bone.

Freezing

Deep frostbite. An injury due to cold involving the skin and the layers below the skin. Deep structures such as bone and muscle may be involved.

Frontal lobe

The frontal part of the cerebrum; site of emotional control.

Frostbite

Superficial freezing. The skin is frozen, but the layers below it are still soft and have their normal bounce.

G

Gallbladder

A pear-shaped sac on the lower surface of the liver, which collects and stores bile.

Gastrointestinal (GI)

Referring to the stomach and intestines.

Generalized onset seizure

Generalized onset seizures affect both sides of the brain, or groups of cells on both sides of the brain, at the same time. Includes tonic-clonic, absence and atonic seizures.

Genitalia

The reproductive organs.

Genitourinary system

The system that includes reproductive organs and the organs that produce and void urine.

Germs

Any disease-causing organism.

Glucose

A simple sugar which is the chief source of energy for most living organisms.

Glycemia

Glucose in the blood.

Glycogen

A complex carbohydrate which is the chief storage form of carbohydrate. It is found in the muscles and liver, and is readily broken down into glucose.

Good Samaritan laws

A series of laws written to protect emergency care personnel. These laws require a standard of care to be provided in good faith, to the level of training, and to the best of ability.

Greenstick fracture

a split along the length of a bone, giving the bone the appearance of a green stick that is bent to its breaking point but without breaking into two or more pieces

H

Heart attack

Usually the sudden blockage of a coronary vessel that can cause death to the heart muscle.

Heat cramps

A condition brought about by the loss of body fluids and possibly salts. It usually occurs in people working in hot environments. Muscle cramps occur in the legs and abdomen.

Heat exhaustion

A form of shock that is caused by the excessive loss of fluids and salts due to heavy sweating. It is characterized by cold, clammy skin and a weak, rapid pulse. It is also called heat prostration.

Heat stroke

An emergency caused by prolonged exposure to heat, resulting in the failure of the body's heat-regulating mechanism. The signs and symptoms are extreme fever, hot and dry skin, delirium, or coma.

Hematoma
Localized collection of blood in the tissue as a result of injury or broken blood vessel.

Hemorrhage
Bleeding, particularly if excessive.

Hemoglobin
The oxygen-carrying pigment of the red blood cells.

Hemorrhagic shock
Caused by the loss of blood and plasma.

Hepatitis
Inflammation of the liver, caused by a virus that is spread though blood-to-blood contact, mucous membranes or sexual contact. Signs and symptoms are nausea, vomiting, fatigue, abdominal pain, and jaundice.

Histamine
A substance released by body cells which causes dilation of capillaries, stimulates visceral muscles and stimulates secretions.

Hives
Slightly elevated red or pale areas of the skin that may be produced as a reaction to certain foods, drugs, infections, or stress.

Hormones
Substances secreted by endocrine glands that act on other glands and organs of the body.

Human immunodeficiency virus
Is a virus that has the capability to affect every organ / system in the body by either direct damage by the virus or by making the host susceptible to opportunistic infections?

Humerus
The upper arm bone.

Hyperglycemia
An excess of glucose in the blood.

Hyperventilation
Abnormally prolonged rapid, deep breathing, usually associated with anxiety.

Hypoglycemia
An abnormally low concentration of glucose in the blood.

Hypothermia
A general cooling of the body.

Hypovolemic shock
The state of shock that develops due to an excessive loss of blood or plasma.

Hypoxia
a diminished supply of oxygen to the body tissues.

I

Iliac crest
The lateral upper long curving portion of the pelvis.

Immersion foot
A form of hypothermia of the foot following prolonged immersion in water. When first removed from water, the foot is swollen, cold, waxy white with cyanotic areas. A short time later the parts become red and hot and swelling increases.

Implied consent
A legal position dealing with a patient who is either unresponsive or so badly injured or ill that he cannot respond. It assumes that the patient would consent to receiving emergency care if capable. Implied consent may also apply to children, the developmentally disabled, or emotionally or mentally disturbed patients when parents or guardians are not at the scene.

Incision
A cut or wound made by a sharp instrument.

Infarction
localized tissue death due to the blockage of its blood supply.

Inferior
Situated below the top of the body.

Inflammation
A tissue reaction to chemical or physical injury or infection. The signs are pain, heat, redness, and swelling.

Informed consent
Actual consent given after the patient knows your level of training and what you are going to do.

Ingest
To take in by mouth.

Inguinal
Referring to the groin.

Inhalation
Drawing of air into the lungs.

Injection
Forcing a liquid through a needle or tube through the skin into the body.

Insomnia
Sleeplessness; usually referring to sleeplessness of unknown origin, not due to illness or disease.

Inspiration
The act of drawing air into the lungs. Also called 'inhalation'.

Insulin

A hormone produced in the pancreas that is needed to move glucose from the blood into the cells.

Insulin shock

Severe hypoglycemia produced by excessive insulin.

Intestine

The part of the digestive system extending from the distal end of the stomach to the anus. Also called bowel.

Intracranial

Within the skull.

Iris

The coloured portion of the anterior eye. It adjusts the size of the pupil.

Ischemia

An inadequate blood supply to an organ or part of the body, especially the heart muscles.

J

Jaundice

The yellowing of the skin, usually associated with liver or gallbladder injury or disease.

Jaw thrust

A method of opening the airway without moving the neck.

Joint

A point at which two bones join.

K

Ketones

End products of the use of fat for the body's routine energy needs.

Kidneys

Two organs located high in the back of the abdominal region, which filter blood and produce urine. They also regulate the salt and water balance of the body.

L

Labour

The three stages of childbirth, including the beginning of contractions, delivery of the child, and delivery of the afterbirth.

Laceration

An injury to the skin and under lying tissues resulting from the forces applied by a sharp or blunt object.

Laryngectomy

Surgical removal of the larynx.

A person who has had this operation is called a neck breather.

Larynx

The airway between the throat and the windpipe. It contains the voice box.

Lateral

To the side, away from the midline.

Lesion

A change, structural or functional, due to disease or injury.

Lethargy

A condition of drowsiness or indifference.

Ligament

A band of fibrous tissue that connects bone to bone.

Liver

A large organ in the right upper quadrant of the abdomen. It stores and filters blood, secretes bile, converts sugar into glycogen, and performs many other functions.

Lumbar spine

The five lowest non-fused vertebrae of the lower back. Located between the thoracic vertebrae and the sacrum.

Lymph fluid

A colourless fluid formed in tissue spaces.

It is returned to central circulation via lymph vessels.

M

Major burn

Any third degree burn; any first or second degree burn involving more than 10 per cent of the body surface; any significant burns involving the face, hands, feet, or genitals; any burns with associated smoke inhalation injury; electrical burns; and any burns encircling a limb.

Mandible

The bone of the lower jaw.

Maxilla

The bone of the upper jaw.

Mechanism of injury

Forces that cause the injury. Consideration is given to the mechanical forces involved in causing an injury, such as the type of force, its intensity and direction, and the body parts that it affects.

Medial

Towards the vertical midline of the body.

Membrane

A thin layer of pliable tissue covering a surface or lining a cavity.

Meninges
The three layers of membranes that cover the brain and spinal cord. They are the dura mater, arachnoid, and pia mater.

Meningitis
Inflammation of the meninges. Particularly dangerous in children.

Metabolism
The conversion of food into energy and waste products.

Metabolic shock
Caused by the loss of body fluids, as in vomiting or diarrhea.

Metacarpals
The five bones of the hand between the wrist and the fingers.

Metatarsals
The five bones of the foot between the ankle and the toes.

Midline
An imaginary vertical line drawn down the centre of the body.

Morphine
A potent narcotic drug derived from opium, used to relieve pain.

Motor nerves
Nerves which cause contractions in skeletal muscles.

Mucous membranes
The lining of some body cavities, such as the mouth.

Mucus
A sticky fluid secreted by mucous membranes.

Muscle
A tissue which produces movement by contraction of an organ or a body part.

If used as a prefix, is referred to as 'myo'.

Musculoskeletal system
All the bones, joints, muscles, and tendons of the body.

Myocardial infarction
Damage or death of a portion of the heart muscle.

Myocardium
The muscular tissue of the heart.

N

Narcotic
A class of drugs that affects the central nervous system for the relief of pain.

Nausea
An unpleasant sensation in the upper stomach area, which often leads to vomiting.

Necrosis
Death of cells or tissue.

Nervous system
Brain, spinal cord, and sensory and motor nerves.

Neurogenic shock
Shock that results when the nervous system fails to control the diameter of blood vessels. The vessels remain widely dilated, providing too great a volume to be filled by the available amount of blood.

Neuropraxia
Neurapraxia is a disorder of the peripheral nervous system in which there is a temporary loss of motor and sensory function due to blockage of nerve conduction, usually lasting an average of six to eight weeks before full recovery.

Nitroglycerin
A vasodilator used in the treatment of angina.

Normal saline (NS)
A solution of salt in water in the same concentration as found in human blood. It is normally supplied in sterile form.

O

Occiput
The back of the skull.

Occlusion
A blockage.

Open fracture
The injury that results when the ends or fragments of a bone cut through the skin.

Also called a "compound fracture".

Organ
A specialized body structure which performs a specific function.

Oropharyngeal airway (OPA)
A curved breathing tube inserted into the patient's mouth. It keeps the tongue from falling back and obstructing the airway.

Oxygen
A colourless and odourless gas which is essential to life. It supports combustion.

P

Packaging
Part of the procedure for removal of the patient from an accident scene. It may involve applying splints and dressings, neck and spine immobilization, and stabilizing impaled objects.

Palate
Roof of the mouth.

Pallor
Paleness; absence of skin colour.

Palpate

To examine by feeling and pressing with the fingers and the palms of the hand.

Pancreas

The large elongated gland in the back of the upper portion of the abdominal cavity, behind the stomach. It produces insulin and digestive juices.

Paradoxical movement

When a loose segment of the injured chest wall moves in opposite direction to the rest of the chest wall during breathing movements.

Paralysis

Complete or partial loss of the ability to move a body part. Sensation in the area may also be lost.

Patella

The kneecap.

Patent

Open, unobstructed, such as in "patent airway".

Pelvis

The lower bony structure of the trunk.

Perfusion

The flow of blood which carries oxygen and nutrients to the cells, and removes carbon dioxide, acids, and wastes.

Pericardial sac

The fibrous membrane around the heart.

Pericardium

A double-layer sac containing the heart.

Peripheral

Pertaining to an outside surface or furthest end.

Peripheral nervous system

The portion of the nervous system consisting of nerves outside the brain and the spinal cord.

Peritoneum

The membrane that lines the abdominal cavity.

Phalanges

The bones of the toes and fingers.

Pharynx

The portion of the airway between the nasal cavity and the larynx.

Physiology

The science dealing with the study of organs or tissues.

Physiological

Pertaining to living tissues or organs.

Pia mater

The innermost of the three meninges membranes of the brain.

Placenta

An organ attached to the lining of the pregnant mother's uterus, which contains special tissues through which the blood of the mother and of the fetus are brought closely together. This allows exchange of oxygen, nutrients, waste products and other substances.

Plasma

The liquid portion of blood.

Platelet

A small cellular elements of the blood that assists in clotting.

Pleura

A double membrane sac. The outer layer lines the chest wall and the inner layer covers the outside of the lungs.

Pneumonia

An inflammation of the lung.

Pneumothorax

The collection of air in the chest cavity to the outside of the lungs, caused by a puncture to the chest walls or the surface of the lung.

Point tenderness

An area of tenderness or pain extending over no more than two or three centimetres.

It can be an important potential sign of bone fracture.

Posterior

Located toward the back. Opposite of Anterior.

Premature infant

Any new-born weighing less than 5.5 pounds (2.5 kg) or being born before the 37th week of pregnancy.

Pressure point

Location on the body where finger or hand pressure can be applied to an artery for the control of heavy bleeding.

Pressure regulator

A device that is connected to an oxygen cylinder to reduce the cylinder pressure to a safe working level, thus providing a safe pressure for delivery to the patient.

Primary assessment

The first examination of a patient to detect life-threatening problems, dealing with Airway, Breathing, Circulation and Disabilities.

Prone

Lying on stomach, face down.

Prosthesis

An artificial body part made to replace a natural one.

Proximal

Closer to the centre of the body.

Psychogenic shock

See "fainting".

Pulmonary
Relating to the lungs.

Pulmonary edema
Abnormal accumulation of fluid in the tissues and air spaces of the lung. It is often secondary to heart failure.

Pulmonary resuscitation
Providing rescue breathing to a patient in an attempt to artificially restore lung function.

Usually called Artificial Respiration.

Pulse
The alternate expansion and contraction of artery walls as the heart pumps blood.

Puncture wound
An open wound caused by a sharp object piercing through the skin and other underlying tissues.

Pus
Tissue fluid containing cell breakdown products of inflammation.

R

Radial pulse
Pulse found on the thumb side of the wrist.

Racoon eyes
Bruising sometimes seen around the eyes after a head injury, and can be a sign of a basilar skull fracture.

Radius
The bone on the thumb side of the forearm.

Realigning
To reposition or adjust into a normal position.

Recumbent
Leaning back or reclining.

Red blood cells
The circulating blood cells that carry oxygen to the tissues and return carbon dioxide to the lungs.

Renal
Referring to the kidneys.

Respiratory arrest
The cessation of breathing.

Respiratory system
A system of organs, which control the inhalation and exhalation of air and conduct the exchange of oxygen and carbon dioxide.

Resuscitation
Any effort to restore or provide normal heart/lung function artificially.

Resuscitator
Mechanical device or equipment used to restore respiration.

Retroperitoneal
Organs that lie behind the peritoneum and against the muscles in the back of the abdomen.

Rotation
The turning movement of a body around it's axis.

Rule of nines
A method used to estimate the amount of skin surface burned. The body is divided into multiples of nine, and these numbers used for the estimate.

S

Sacrum
The 5 fused vertebrae of the lower back which form a triangular shaped bone. It is inferior to the lumbar spine.

Saline
A solution containing salt.

Scapula
The shoulder blade.

Sciatic nerve
A nerve emerging from the base of the spine and runs down to the lower thigh, where it divides into two.

Secondary survey
The patient interview and the physical examination performed after the primary survey. This is done to detect any problems that may become life threatening.

Second-degree burn
A partial thickness burn where the outer layer of skin (epidermis) is burned through and the second layer (dermis) is damaged.

Seizure
Generalized, uncoordinated muscular activity usually associated with loss of consciousness; a convulsion.

Semi-prone
A position part way between lying on the side and lying on the stomach. The upper legs are bent and the head is turned to the side, supported by the lower arm.

Sensory nerves
Peripheral nerves which conduct the sensation of touch, pain, temperature, taste, and smell to the brain.

Septic shock
Is caused by infection producing poisons that are released into the blood. The blood vessels dilate, producing too great a volume to be filled by the body's blood supply.

Shock
A depression of body functions which results from the progressive failure of the cardiovascular system.

Sign
Bodily evidence of disease or injury found on physical examination.

Sling
A large triangular bandage or other cloth device that is applied as a soft splint to immobilize possible fractures and dislocations.

Spasm
Involuntary contraction of a muscle or several muscles.

Spinal cord
The part of the central nervous system which extends from the lowest part of the brain to the upper lumbar vertebrae.

Spleen
An organ located in the left upper quadrant of the abdominal cavity behind the stomach. It stores blood and destroys old blood cells.

Splint
Any device that will immobilize a fracture.

Sprain
An injury in which ligaments are partially torn or stretched.

Standard of care
The minimum accepted level of emergency care. It is set forth by law, administrative orders, guidelines published by medical and emergency care organizations, local protocols and practices, and precedent.

Sterile
Free of all life forms.

Sternum
The breastbone.

Stoma
The opening in the neck of a neck breather.

There may or may not be a tube in the neck opening.

Strain
Injuries to muscles caused by over stretching.

Stridor
A harsh, high-pitched breathing sound.

Stroke
The result of blockage in an artery supplying oxygenated blood to the brain.

Headache, confusion, paralysis (often to one side), impaired vision and speech, unequal pupil signs and many other signs and symptoms. This is also called a cerebrovascular accident or CVA.

Subcutaneous
Beneath the skin. It refers to the fats and connective tissues found just below the dermis.

Subcutaneous emphysema
A condition in which trauma to the lung or airway results in the escape of air into the tissues of the body, especially along the chest walls, neck and face. It is characterized by a crackling sensation when palpating the skin.

Subdural
Between the dura mater and the arachnoid (see Meninges).

Substernal
Under the sternum. Sub-sternal pain maybe the an indication of cardiac problems.

Sucking chest wound
An open chest wound into which air is sucked through the wound and into the chest cavity each time a patient breathes.

Sudden infant death syndrome (SIDS)
Death from unknown cause occurring during sleep in an otherwise healthy infant; also called crib death.

Superficial
On the surface.

Superior
A part of the body located above another part.

Supine
Lying flat on the back, face upwards.

Symptom
Evidence of injury or illness as felt by and told to you by the patient.

Syncope
Fainting; a brief loss of consciousness caused by temporarily inadequate blood flow to the brain.

Syndrome
A group of signs and symptoms which together characterize a condition or a disease.

Systemic
Pertaining to or referring to the entire body.

Systole
The contraction phase of the cardiac cycle.

Systolic blood pressure
The higher pressure exerted by the blood on artery walls when the heart is contracting.

T

Tachycardia
Rapid heartbeat, usually more than 100 beats per minute.

Temporal
Referring to the temple.

Tendon
Fibrous tissue that connects muscle to bone.

Tension pneumothorax
The condition in which air progressively enters the pleural space and cannot escape, causing progressive increase in inter-pleural pressure, impairment of respiration and pressure on the heart.

Third-degree burn
A full thickness burn, where all layers of the skin are damaged. Deep structures may also be burned.

Thoracic cavity
The anterior body cavity above the diaphragm.

Tonic-clinic seizure
A type of generalized seizure. A convulsion where the person loses consciousness, muscles stiffen and jerking movements are seen. Previously identified as a grand mal seizure.

Tourniquet
A tourniquet is a constriction device intended to impede circulation distal to the point of application on an extremity. It can be expected to result in tissue loss or damage distal to application, and is to be used only in the case of exceptional and catastrophic injuries such as major amputations.

Trachea
The trachea, or windpipe, is the upper section of the airway separated from the pharynx by the larynx.

Traction
A part of the action taken to pull gently along the length of the limb to stabilize a broken bone to prevent further injury.

Transient ischemic attack (TIA)
A minor stroke of short duration which occurs when the blood flow through a narrowed brain artery is temporarily inadequate to support the function of the brain area supplied by that artery. Dizziness, numbness, general weakness, vision problems, and unconsciousness may occur.

Trauma
An injury caused by a mechanical or physical factor.

Trench foot
A chronic cold injury caused by long periods of time in cold water, snow or mud.

Triage
A method of categorizing and sorting patients according to the severity of their injuries.

Tibia
The shin bone.

Tissue
A collection of similar cells that are specialized to perform a specific function.

Topical
Local, usually applied to a surface.

Toxic
Poisonous.

U

Ulcer
An open lesion of the skin or mucous membrane.

Ulna
One of the two bones of the forearm, on the side opposite that of the thumb.

Umbilical cord
The structure that connects the body of the fetus to the placenta.

Umbilicus
The navel.

Universal precautions
Recommendations for emergency and medical personnel to wear protective gloves, eye protection, masks, and gowns to avoid contact with the patient's blood, body fluids, wastes, and mucous membranes.

Unknown onset seizure
An unknown onset seizure is when the beginning of the seizure is not known. It may later be diagnosed as a focal onset or generalized onset seizure.

Unresponsive
Incapable of responding to any stimuli.

Ureter
Tubes leading from the kidneys to the bladder.

Urethra
Tube leading from the bladder to the outside of the body.

Uterus
The hollow muscular structure in which the fetus develops. The womb.

V

Vagina
Genital canal in the female extending from the uterus to the vulva; the birth canal.

Varicose Veins
Dilated, enlarged veins whose valves are damaged. The most common site is the veins of the legs.

Vasoconstriction
Narrowing of the diameter of a blood vessel.

Vasodilation
Widening of the diameter of a blood vessel.

Vein

Any blood vessel that returns blood to the heart.

Venous bleeding

The loss of blood from a vein. It is usually dark red to maroon in colour. Loss is usually a steady flow and can be very heavy.

Ventilation

Moving air into the lungs.

Ventral

Refers to the front of the body.

Ventricle

The two lower, muscular chambers of the heart which receive blood from the atria and pump it into the lungs or general circulation.

Ventricular fibrillation

Disorganized rapid contractions of the ventricular muscles. They are ineffective in pumping blood.

Vertebra

One of 33 bones of the spinal column.

Vessel

Tube or canal for carrying blood or lymph fluid.

Vital signs

Indicators of body functions necessary to life.

They include pulse rate and character, breathing rate and character, skin condition, and level of consciousness.

W

White blood cells

Help defend the body from infection.

Workplace Hazardous Materials Information System (WHMIS)

The Workplace Hazardous Materials Information System (WHMIS) is a comprehensive plan for providing information on the safe use of hazardous materials used in Canadian workplaces.

X

Xiphoid Process

The xiphoid process is a small protrusion at the lower part of the sternum. Its importance lies in the fact that it is easily broken in improperly conducted CPR, and can then result in major internal bleeding.

AFA Documents

Sample Intervention Report _____ 383

Sample Intervention Report

CSP Intervention Report

Date _____ Location _____ Time _____

Name _____ Phone # _____

D.O.B. _____ Age _____ Gender _____

Address _____

_____

Contact name _____ Phone # _____

Relationship _____ Email _____

Chief Complaint: _____

_____

Primary Assessment Concerns:

Airway:	Y	N
Breathing:	Y	N
Severe bleeding:	Y	N
Level of Consciousness:	Y	N
Spinal:	Y	N

Pain:

Onset _____

Provoke _____

Quality _____

Radiation _____

Severity _____

Time _____

Vital Signs	1	2	3
Time			
Breathing	Rate Deep/Shallow Normal/Laboured	Rate Deep/Shallow Normal/Laboured	Rate Deep/Shallow Normal/Laboured
Pulse	Rate Strong/Weak Regular/Irreg	Rate Strong/Weak Regular/Irreg	Rate Strong/Weak Regular/Irreg
Blood Pressure	Radial estimate _____ BP cuff _____	Radial estimate _____ BP cuff _____	Radial estimate _____ BP cuff _____
L.O.C.	A V P U	A V P U	A V P U
Pupils	Equal & Reactive Unequal Fixed Other	Equal & Reactive Unequal Fixed Other	Equal & Reactive Unequal Fixed Other
Skin	Moist Normal Pale Dry Flushed	Moist Normal Pale Dry Flushed	Moist Normal Pale Dry Flushed
Pain	0 1 2 3 4 5 6 7 8 9 10	0 1 2 3 4 5 6 7 8 9 10	0 1 2 3 4 5 6 7 8 9 10

Fracture

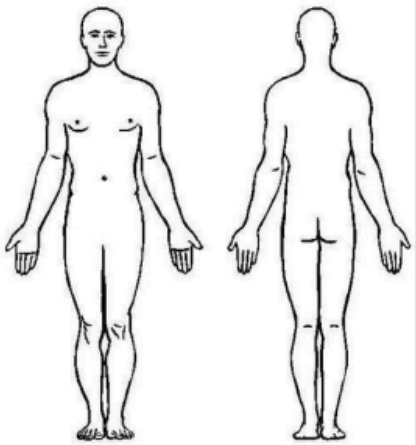
O Abrasion

+++ Laceration

X Pain location

X→ Radiating pain

/ Amputation



Time: Last meal _____

Time: Last pass urine _____

Recent serious illness, injury, operations? (list) Y N

_____

Dentures?	Y	N	
Contact lenses?	Y	N	
Bleeder?	Y	N	
Alcohol/Drugs?	Y	N	_____
Allergies?	Y	N	_____
MedicAlert?	Y	N	_____
Medication?	Y	N	_____
Medical conditions?	Y	N	_____

Incident (mechanism of injury) details: _____

_____

_____

_____

Suspected Injury(s)/Condition(s): 1. _____

2. _____

3. _____

Treatment: 1. _____

2. _____

3. _____

4. _____

2022 v1

CANADIAN SKI PATROL